The Victorian Naturalist

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Special Issue: Introduced Animals and Plants

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GENERAL MEETINGS

At the National Herbarium, the Domain, South Yarra.

Monday, 9 February, 8.00 p.m.
The Conservation Council of Victoria and its activities.
Speaker: G. Westcott, Director, C.C.V.

Monday, 16 March, 8.00 p.m.
Victorian opisthobranch molluscs.
Speaker: Mr R. Burn, National Museum of Victoria.

Monday, 13 April, 8.00 p.m.
Otway study night, There will be several keynote speakers, and all groups are asked to prepare a short address.

New Members — January/February meetings.

Ordinary
J. Eagles, 25 Hodgson St., Lower Templestowe.
Miss Georgie Hodges, 1/11 Union Rd., Surrey Hills.
Mrs. K. Hoogeduere, 4/6A Erelidoune Ave., Hawthorn.
Bertram Lobert, 29 Aubrey Grove, Boronia.
Merryl Martindale, 2 Sellwyn St., Canterbury.
Joan Miller, 29 Rochester Rd., Canterbury.
Ann Payne, 3/1 Lawson Grove, South Yarra.
Nicolette Robson, 30A Dixon St., Malvern.

Joint
E. & J. Moorhouse, P.O. Box 379, Deniliquin.
Mr and Mrs John Stuwe, Botany Dept., Latrobe University.
M. Vanderzee & J. Phillips, 136 Macpherson St., North Carlton.

Country
Michael Dexter, "Springhill", Yarra Glen Rd., Coldstream.
Peter Matthews, P.O. Box 249, Mornington.
Ron Walsh, 54 Murray Anderson Rd., Rosebud.

FNCV EXCURSIONS

Saturday, 7 — Monday, 9 March. Castlemaine. This is the weekend of the annual meeting and get-together of the Victorian Field Naturalists Clubs Association, which will be hosted by the Castlemaine FNC. This year members of the Western Victorian Field Naturalist Clubs will attend. There will be a selection of half-day trips leaving the car park in Downes St., next to the Botanic Gardens at 9.30 a.m. and 1.30 p.m. on Saturday, Sunday and Monday. Saturday evening programme: 6.30 p.m. Business meeting W.V.F.N.C.A.. 8.00 p.m. Launching of Cliff Beauglehole's "Distribution and conservation of vascular plants of the alpine area, Victoria". 8.15 p.m. Propagating native plants; birds of the north-central area. Sunday evening programme: 6.30 p.m. Annual meeting V.F.N.C.A. 8.00 p.m. the Castlemaine district, by C.F.N.C. members. Both meetings at the Uniting Church Hall, corner Baker and Campbell Sts. A coach has been chartered for the weekend and motel accommodation booked, B&B, at the cost of $60.00 per person for a limited number. Many will be camping. The coach will leave Flinders St. at the Gas and Fuel at 8.30 a.m. Bring a picnic lunch. A deposit of $10.00 should be paid to the Excursion Secretary when booking by those who require motel accommodation.

Sunday, 5 April. Organ Pipes National Park. The coach will leave Batman Avenue at 9.30 a.m.; fare $5.50. Bring a picnic lunch. A great amount of work has been done on this Park and it is worth a visit if you have not been there recently.

Sunday, 3 May. Pirianda Gardens. The coach will leave Batman Avenue at 9.30 a.m.; fare $6.00. Bring a picnic lunch.

Preliminary notices:

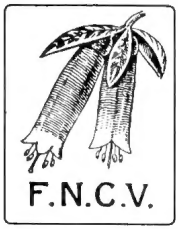
Saturday, 17 October — Friday, 6 November. New Zealand, North Island. This is dependent of sufficient members being interested, but many places on this itinerary are not included in most of the regular tours. Tentative programme is: Oct. 17 fly to Auckland; Oct. 18 Auckland/Coromandel/-Whitianga; Oct. 19 Whitianga/Tauranga; Oct. 20 Tauranga/Rotorua; Oct. 21 Rotorua/Whakatane; Oct. 22 Whakatane/Hicks Bay; Oct. 23 Hicks Bay/-Gisborne; Oct. 24 Gisborne/Wairoa; Oct. 25 Wairoa/Napier, visiting Urewera National Park; Oct. 26 Cape Kidnappers/Napier; Oct. 27 Napier/-New Plymouth; Oct. 28 New Plymouth; Oct. 29 New Plymouth/Tongariro National Park; Oct. 30 National Park; Oct. 31 National Park/Auckland; Nov. 1 Auckland/Kaitaia; Nov. 2 Cape Reinga/-Kaitaia; Nov. 3 Kaitaia/Bay of Islands; Nov. 4 Bay of Islands; Nov. 5 Bay of Islands/Auckland; Nov. 6 Auckland/Melbourne. Cost would vary according to numbers going and possibly rise but it is expected to be approximately $1250. Please let Excursion Secretary know if you are interested.

Special study trips:

Contact Wendy Clark for details (AH 859 8091)

Saturday, 21 — Sunday, 22 February. Bat-catching expedition to Daylesford region. Bring all camping gear and food.

Sunday, 22 March. Fossil excursion to limestone quarry at Geelong.



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Cover illustration: An unusual malformed shell (*cornucopiae*) variant of the common introduced garden snail, *Helix* (*Cryptomphalus*) *aspersa*. Specimen found at Lakes Entrance.

Club Awarded Victorian Conservation Prize for 1980

The Victorian Conservation Prize for 1980, awarded annually by the Conservation Council of Victoria for outstanding contributions in the field of conservation, was awarded to the Field Naturalists Club of Victoria. The prize, a large oil painting by the conservation artist Mr Neil Douglas, was presented to the President of the Club by The Honorable Rupert Hamer, M.P., Premier of Victoria in the Melbourne Room, Treasury Place on Monday, 8 December 1980. The presentation was made in the presence of a large gathering of specially invited guests from conservation bodies and research institutions from throughout Victoria.

The citation with this year's prize reads as follows:—

"The Victorian Conservation Prize (Neil Douglas Award) for 1980 has been awarded to the Field Naturalists Club of Victoria.

Since its inception in May 1880 the Club has been in the forefront of organisations devoted to the study and preservation of Victoria's heritage of plant and animal life.

The diversity and specialisation of the Club's activities may be seen in the work of its various sub-groups of Mammal Survey, Botany, Geology, Microscopy, Marine Biology and Entomology.

Publication of the bi-monthly journal, "The Victorian Naturalist", and an impressive list of standard reference texts has provided Victoria, and indeed the world, with a wealth of scientific data.

Together with such other societies as the Victorian National Parks Association, the Native Plants Preservation Society, the Mammal Survey Group and the Society for Growing Australian Plants which all grew from the F.N.C.V., the Club continues to make lasting and valuable contributions to Victoria's natural history."

The receiving of this prize rounded off a very successful Centenary Year for the Club. I would like to thank the Council and members of the Club for their magnificent support during the Club's centenary year.

Brian J. Smith
President

Symposium on the Effects of Introduced Animals and Plants in Australia

This one-day symposium, on the effects of introduced animals and plants in Australia, was held on Sunday 27 July at the State College of Victoria — Rusden. Jointly sponsored by the F.N.C.V. and the State College, the symposium was organised by the Senior Lecturer in Environmental Studies at the College, Mr Rob Wallis. The symposium was attended by over 80 students and club members and members of various natural resources research bodies. Following the opening address by Senior Lecturer in Zoology at Latrobe University, Mr Peter Rawlinson, 12 papers were presented on all aspects of the topic and lively discussions were generated by these papers. Six of the papers, covering the field are reproduced in the issue of this **Naturalist.** The texts of all the papers presented will be published as a separate publication by Rusden State College.

Introduced Mammals in Victoria

By
HANS BRUNNER† P. L. STEVENS† and J. R. BACKHOLER†

Introduction

Since the advent of white man in Australia, many species of mammals have been introduced into this country. Some of these species were brought in as domestic livestock for the supply and production of meat and wool, while other species were introduced for sport and recreation, as pets, and for the misguided endeavours of the Victorian Acclimatization Society. A few species such as rats and mice were introduced accidentally, presumably with infested ships cargo. Unfortunately, many of these species have been able to escape into our wilderness, farming and urban areas, and have successfully managed to breed and establish colonies in a wide range of habitats. In Victoria, about twenty species of introduced mammals are living in the wild, some of course more successfully than others (Table 1). Most of these have since been declared as pest or vermin animals.

Surprisingly, the release of exotic mammal species is still continuing. Two species of deer, the hog deer (*Axis porcinus*) and the fallow deer (*Dama dama*) have recently been released into Victorian forests and bushland for future sport. Unconfirmed reports to the Victorian Deer Advisory Council suggest the presence of yet another species, Japanese sika (*Cervus nippon*) in the Mallacoota area (Anderson 1978). At least four species of deer: hog, sambar, red and fallow are now roaming wild in large numbers in the Eastern Highlands where they may exert pressure on the already oppressed native fauna and flora by competing for food and shelter. In New South Wales' Royal National Park, culling of rusa has been necessary because of their high numbers (Anderson 1978). Because of damage done to vegetable crops by sambar deer in the Upper Yarra area, they were declared vermin in three Shires from 1951-61. Deer are also a potential host for various viral and bacterial diseases and can harbour helminth parasites and roundworms which are found in sheep

Table 1. Mammals introduced into Victoria, which are capable of living in the wild

-	*Rattus rattus*	Black rat, Ship rat
-	*R. norvegicus*	Brown rat, Norway rat
-	*Mus musculus*	House mouse
•	*Oryctolagus cuniculus*	Rabbit
•	*Lepus capensis*	Hare
•	*Canis familiaris*	Domestic dog
•	*Vulpes vulpes*	Fox
	Mustela putorius	Ferret
	Felis catus	Cat
	Equus caballus	Horse
•	*Sus scrofa*	Pig
+	*Dama dama*	Fallow deer
+	*Axis porcinus*	Hog deer
+	*Cervus unicolor*	Sambar
+	*C. elaphus*	Red deer
+	*C. timorensis*	Rusa
+	*Axis axis*	Chital
	Bos taurus	European cattle
	Capra hircus	Goat
	Ovis aries	Sheep

- = control is legislated under Health Act 1958
• = control is legislated under Vermin and Noxious Weeds Act 1958
+ = protected under Wildlife Act 1976.

† Department of Crown Lands and Survey, Keith Turnbull Research Institute, Frankston, Victoria, 3199.

and cattle (Anderson 1978). Military-like hunting operations with four-wheel drive vehicles and packs of dogs are often even more destructive than the deer themselves. Whilst considerable effort is spent on the management and protection of deer for the benefit of only a smal section of the community, it is ironical that the native wombat (*Vombatus ursinus*), doing relatively little harm other than to rabbit fences, is still declared vermin. It has been suggested that goats may be used to control blackberry in timber crops. Will Australia eventually become an open zoo?

A number of the species in Table 1 are considered to be important in terms of economics, disease and wildlife conservation. Thus, feral dogs and cats, foxes, pigs and rabbits are treated separately and aspects of their distribution, breeding, diet and control are discussed below. However, mice, particularly in plague years, and rats in urban and farm areas, are also of economic and public health significance.

Any detailed studies on the effects of introduced species in wilderness areas would be extremely complex. In most situations, scientists are asked to "focus in" on one species at a time, and so wider interpretations of their specific findings can often be expressed only in general terms. It is important to realize that when attempts are made to assess the impact these exotic intruders make on our native fauna and flora, we give consideration to all factors that may affect the latter. This should include all introduced animals, plants and, of course, man. The disappearance or reduction in numbers of indigenous predators such as the thylacine (*Thylacinus cynocephalus*), the tiger quoll (*Dasyurus maculatus*) and the eastern quoll (*Dasyurus viverrinus*) have only added to our speculation regarding the impact that introduced predators may have exerted on them.

FOXES

General

The first introductions of the European red fox (*Vulpes vulpes* L.) to Australia took place in the 1860s and 1870s with most releases being near Melbourne (Rolls 1969). The main purpose of the releases was to provide sport for "Colonial Gentlemen" and there was generally little thought as to the possible harmful effects of fox introduction. The subsequent spread of the species was rapid. Foxes are able to survive and indeed flourish in a large variety of habitats ranging from rain forest to semi-desert but it would seem that they prefer to live in areas disturbed by man. Studies in America and Europe indicate that a family of foxes establishes a home range of about 5-7 square kilometres. The territorial boundaries are generally well established and often conform to natural physical boundaries such as roads, streams and lake shores.

Distribution

Foxes range over some two-thirds of the continent, their northern limit being within 100 miles of the Gulf of Carpentaria. In Victoria, the density of foxes appears to be greater in closely settled agricultural areas and this is undoubtedly linked to food supply. Even large towns and cities support a resident fox population.

Breeding

Vixen are mono-estrus and are receptive to the male fox for only a few weeks of the year. In Australia adult males are probably infertile from September to March of the following year. Both vixen and male foxes are sexually mature at ten months of age and according to overseas work, nearly all healthy vixen produce a litter every year. In Australia, only few adult vixen are barren. This, combined with an average litter size of 4-5 viable young, accounts for the very high rate of reproduction amongst foxes in the field. According to overseas studies, the gestation period is usually 51-52 days.

The young are born and reared in a den, which is usually an enlarged rabbit burrow. However stone heaps, hollow logs and natural caverns are frequently utilized as breeding sites. The vixen establishes the den site and may scratch out several dens. The young often utilize two or three dens in a confined area.

Weaning takes place after the first month or so and the young may frequent the natal den (or neighbouring dens) for several months thereafter. Dispersion usually takes place in late summer or early autumn. The sex ratio in Victoria and New South Wales shows a preponderance of males over females (Coman 1973a; Croft and Hone 1978).

Diet

Extensive investigations on the diet of foxes in Victoria indicate that the fox is an opportunist predator and scavenger, consuming an extremely wide variety of foods. The importance of any particular food item in the diet is heavily dependent on the relative availability of that food. Hence, there are marked differences in the diet of foxes from various habitat types and seasonal changes in diet are quite evident. In areas of agricultural or pastoral land, rabbits, house mice and sheep are the most important mammalian foods eaten. However, in heavy forest areas, largely undisturbed by man, native mammals are consumed in large quantities and they appear to compensate for the lack of rabbit, sheep and house mice in these situations (Coman 1973a; Brunner *et al.* 1975, 1976, 1977).

The seasonal variation in incidence of various food items is marked. During summer, large numbers of insects and fruits (particularly blackberries) are eaten. At times, insects or wild fruits account for the bulk of the fox's dietary intake. Nevertheless, the fox is primarily a carnivore preying on smaller mammals and feeding on carcasses of larger ones.

Disease

In Australia, we are fortunate that our fox population is probably not involved in the spread or persistence of any disease which has a major economic or public health significance. Nevertheless, foxes harbour a wide range of viral, bacterial, protozoan, helminth and arthropod organisms which may or may not exert some pathogenic affect upon their host.

Distemper, hepatitis and mange appear to be the major disease conditions in Australian foxes, although there is no documented evidence of the effects of these diseases on the fox population. Disease outbreaks appear to be sporadic and follow no definite pattern. However, there is some presumptive evidence that serious disease outbreaks amongst foxes occur only when the fox population in a particular area is high. The helminth parasites of foxes in Australia have been investigated in detail and at least four species of tapeworms and six species of roundworms are known to parasitize the animals (Coman 1973b).

We are fortunate that the fox in Australia does not act as a carrier for the hydatid tapeworm, *Echinococcus granulosus*. In some other parts of the world, foxes are important hosts for this parasite.

Foxes harbour a number of external parasites, the most important of which are the mange mites. Species of fleas, lice and possibly ticks also occur on foxes. The viral and bacterial diseases of foxes have been poorly studied, but leptospirosis and toxoplasmosis are known to occur in foxes.

Economic damage

Although foxes have often been considered responsible for heavy losses in lambs, there is little evidence to support this. Investigations indicate that, although large amounts of sheep material may be eaten, most of this is in the form of carrion. Lamb mortality studies suggest that the fox has probably been over-rated as a predator of viable lambs (McFarlane 1964). Despite this, one cannot deny that individual farmers sometimes suffer heavy lamb losses because of the activities of individual "rogue" foxes.

A bounty payment system which was introduced in Victoria in 1949 has now been revoked. The payment per scalp was 75c and in 1977 a peak annual return of over 100,000 scalps was achieved. The current value of fox skins compensates hunters well for their efforts.

Environmental aspects

The Victorian studies on fox diet indicate that substantial predation upon indigenous fauna occurs in areas of heavy forest or scrub. It is commonly

believed that this poses a serious threat to the existence of many of our smaller indigenous fauna species. However, as foxes have become dependent on small native mammals in these areas as their staple food, it should be remembered that, after more than a century of this predator-prey relationship, there appears to be still an abundance of most of the small indigenous fauna species throughout these areas. The disappearance of certain prey species in more vulnerable areas such as small and isolated reserves or in desert lands, is possibly the result of additional pressure on those species by cats, dogs and by man. Nevertheless, the wisest policy is to take the view that fox predation on indigenous fauna is undesirable and should be minimized.

Foxes with mange could spread this disease to wombats and if rabies came to Australia, foxes would most likely be the principal agent in the spread of this disease to mammals, including man. In late summer foxes eat large quantities of blackberries. The seeds in the droppings germinate readily and so the fox assists in the spread of this weed (Brunner *et al.* 1976).

Control

A variety of means have been used to control foxes in Victoria. These include poisoning, daylight drives, fumigation of dens and night spotlighting. The most efficient technique is probably that of poisoning, as foxes are extremely susceptible to 1080 poison. Fumigation of dens with chloropicrin or similar products is a useful control measure in summer, when juveniles and vixen are still in the dens. It is probably unwise to destroy established dens by digging or explosives, since the foxes will then establish new den sites in other areas. It is better to have the animals using the same known dens year after year and to fumigate these every breeding season when signs of activity are obvious.

Night spotlighting is often employed in fox control, particularly during lambing time, when control of individual "killer" foxes is desired.

DINGOES AND FERAL DOGS

General

The dingo (*Canis familiaris dingo* Blumenbach, 1780) is generally considered to be a native mammal, although it may have been in the country for only some 10,000 years or so. The origin is unknown but it is thought to be in the ancestral line from primitive dog to present domestic dog. Indeed, it is very difficult to separate dingoes from ordinary domestic dogs on the basis of blood tests, skull measurements etc. Many people use the coat colour of the animal as a means of discrimination, but black and tan as well as yellow dingoes may be recognized.

Feral domestic dogs (*Canis familiaris familiaris*) or hybrid animals resulting from inter-breeding with dingoes are a more recent addition to our bushland. They undoubtedly originated from straying farm dogs in the early days of settlement. Domestic dogs and dingoes inter-breed freely so that we now have dingoes, cross-breeds and feral domestic dogs roaming the bush.

Distribution

Dingoes and feral dogs are in all States except Tasmania but are of most concern in the more arid pastoral zones of Western Australia, South Australia, Northern Territory and Queensland as well as the heavily forested Eastern Ranges of New South Wales and Victoria. They are usually in areas remote from human habitation and are by nature rather shy animals. In Victoria they are found throughout the Great Divide from the New South Wales border to the area about Healesville and Marysville. They are also in extensive areas of the more rugged country in the north-east of the State. Dingoes may still be present in the north-west of the State (Little Desert — Big Desert) and an animal assumed to be a dingo was killed near Natimuk recently. However, reports from the north-west region are few.

Dingoes are not found in the wild outside Australia but recently dog fanciers in other countries have shown great interest in breeding the dingo as a "show" dog.

Breeding

Dingoes differ from feral dogs in that they breed only once a year. Domestic dogs can breed at least three times in two years.

Dingoes mate between April and June and have their young between June and August. Like domestic dogs, the gestation period is about 63 days. Not all bitches breed in their first year and this is often taken to indicate social subordination of these younger animals by older animals. Males have an annual sexual cycle and very few sperm are produced in summer.

The dingo bitch produces an average of five pups usually in places such as large hollow logs, natural caverns etc. According to some recent research work, there is evidence to suggest that not only parents, but also non-breeding young animals (first year) help rear the young (Newsome *et al.* 1973).

Diet

Dingoes and feral dogs eat a great variety of food, ranging from large native mammals through to insects, fruits and herbs. The introduction of livestock and rabbits to Australia has extended their range of food items. The results of a dietary study of Victorian dingoes and feral dogs are shown in Table 2. On a volume basis, wallabies and wombats are the major food items. It can be seen from the Table that sheep and cattle form only a small part of the diet. Nevertheless, it must be remembered that individual dogs can cause heavy stock losses from time to time (Coman 1972a). In Western Australia the most common food for dingoes was found to be the red kangaroo (*Macropus rufus*) and the common wallaroo (*M. robustus*) (Whitehouse 1977). In Central Australia the major items in their diet are the rabbit, the long-haired rat (*Rattus villosissimus*), the house mouse (*Mus musculus*), the spinifex hopping-mouse (*Notomys alexis*) as well as lizards and birds (Newsome *et al.* 1973).

Parasites and diseases

The most important parasite of dingoes and feral dogs in south-east Australia is, undoubtedly, the hydatid tapeworm. This worm is probably present in 80-90% of these dogs, but is very rare in domestic farm dogs in the same areas. The hydatid worm is important because its intermediate stage (hydatid cyst) is found in man, domestic animals and native animals. The disease in man can be fatal and it may well kill some native mammals. Recent Victorian research has shown that the high incidence of hydatid worms in dingoes and feral dogs is probably due to the fact that dogs eat large numbers of infected wallabies (i.e. wallabies with hydatid cysts) (Coman 1972b). This is a self-perpetuating cycle, the wallabies picking up hydatid eggs from grass and herbage around dog faeces. Man can become infected by handling dingoes or feral dogs and strict hygiene should be practised. In addition to hydatid tapeworms,

Table 2. Food items in stomach contents of 166 dingoes and feral dogs in Victoria (Coman 1972)

Food items	Percentage occurrence in diet
MAMMALS	
Wallaby (*Wallabia bicolor*)	23
Wombat (*Vombatus ursinus*)	20
Eastern grey kangaroo (*Macropus giganteus*)	7
Possum (chiefly *Trichosurus vulpecula*)	7
Echidna (*Tachyglossus aculeatus*)	6
Rabbit (*Oryctolagus cuniculus*)	6
Sheep (*Ovis aries*)	4
Cattle (*Bos taurus*)	3
BIRDS	5
REPTILES	6
INSECTS	33
HERBAGE	85

dingoes and feral dogs harbour a number of other helminth parasites such as the sheep and cattle bladderworm (a tapeworm of dogs of which the intermediate stage is seen as large watery bladders attached to the gut of sheep and cattle) and also roundworms and hookworms (Coman 1972a).

Dogs can also become infected with mange, distemper, hepatitis and a variety of other diseases, and if rabies came to Australia, dogs could be important carriers. Generally the animals seem to have little influence in the spread of important livestock diseases. The possible exception to this could be hydatid disease.

Economic importance

Despite a huge amount of folklore and over 150 years of control work, we still have little idea of the real damage caused by dingoes and feral dogs. There can be no doubt that severe losses of livestock occur from time to time. A recent survey shows that livestock predation in Victoria is confined almost entirely to sheep flocks (Stevens and Coman unpublished data).

Control of dogs itself is a fairly expensive operation. Each year the Victorian Department of Crown Lands and Survey alone spends some $300,000 on dog control.

Aerial poisoning of dogs has not been carried out in Victoria for a number of years as it is considered to be relatively non-specific. Also the success of such poisoning is difficult to measure. It is unlikely that aerial poisoning of dogs will be considered in the future.

Ground poisoning of dogs, using carefully prepared poison doses and well placed baits appears to be more promising. Dogs are extremely susceptible to 1080 poison and, using this fact, it may be possible to produce a bait which is effective on dogs but less dangerous to desired wildlife species (Rathore 1980). Combining this selectivity with carefully placed baits could very well result in the control of many dogs with a minimum risk to other animals. However, it appears that not all dogs will take baits and, therefore, poisoning cannot completely replace trapping.

FERAL CATS

General

A feral cat is best defined as a cat (*Felis catus* L.) which obtains its own food by hunting and scavenging. Feral cats may live in close proximity to human habitation or may be completely isolated in the bush. Since cats kept as pets also roam and hunt, a precise distinction between feral and straying animals can sometimes prove difficult.

The cat was first domesticated in Egypt about 3,500 years ago and now has a world-wide distribution. It is probably true that most countries having domesticated cats also have a feral population.

Despite a pronounced coat colour polymorphism, cats show little variation in size and average females weigh 2.3 — 3.0 kg and average males 3.5 — 6.0 kg. There is no sound evidence to suggest that the average feral cat is larger than the average cat kept as a pet. They are both the same species (Scott 1972; Jones and Coman personal communication).

Distribution

Feral cats occur in all habitats in Australia (Anon. 1977; Bolton and Latz 1978; Marshall 1966). They are found in the Gibson Desert, the Kimberleys and Cape York Peninsula and even on subantarctic Macquarie Island. In the more densely settled areas feral cats appear to be concentrated about garbage dumps, picnic sites and camping grounds. The density of cats in various parts of Australia is unknown but at Macquarie Island densities may reach up to seven cats per square kilometre (Jones 1977).

Breeding

Female cats may have from 1 to 8 kittens per litter, but the usual litter size is from 3-5. Gestation lasts for 65 days and kittens are born between spring and late summer. Each breeding cycle takes a minimum of 4½ months and one female may produce two litters per year. Kittens weigh an average of 100g at birth and are weaned after six weeks. Preliminary observations suggest that litters are born and raised in rabbit burrows, rock piles and, possibly, hollow logs. In all other

respects, breeding of feral cats is likely to be the same as breeding in domestic cats.

Diet

Research in Victoria suggests that feral cats will eat a wide variety of food and their prey at any time of the year consists largely of those species which are most abundant and easily caught (Coman and Brunner 1972). Mammals (particularly rodents and lagomorphs), birds, reptiles, amphibians, fish, insects, carrion, human garbage and plant material are all eaten. In areas of high rabbit density, rabbits are by far the most important food item. Similar results have been obtained in a more recent dietary study on feral cats (Jones and Coman personal communication). Usually cats hunt at night and peak activity is thought to be at evening or early morning. The diet of feral cats in Victoria varies markedly depending on the habitat. The results of a dietary survey carried out in 1969-70 in agricultural and forest areas are summarized in Table 3 (Coman and Brunner 1972).

The greater reliance on native mammals in heavy forest is, no doubt, linked to the fact that such animals are usually more common in bush areas whilst mice and rabbits are less common.

Disease

Probably the most important disease transmitted to man and to domestic and free living animals by cats is toxoplasmosis (*Toxoplasma gondii*). It can lead to serious foetal damage (rare in humans) if the mother is infected during pregnancy. It is also a fairly serious disease of livestock especially sheep in New Zealand and Tasmania and it must be assumed that feral cats play some part in its transmission.

A wide range of native animals have been found to be infected with toxo-

Table 3. Food items of 80 feral cats in Victoria expressed both as percentage by volume and as percentage occurrence

Food item	Agricultrual and pastoral land		Heavy forest	
	Volume	Occurrence	Volume	Occurrence
MAMMALS	91.5	81.5	85.7	60.6
Introduced spp.				
Oryctolagus cuniculus	62.0	29.6	20.5	11.3
Mus musculus	27.0	40.7	11.8	7.5
Ovis aries	1.5	3.7	0.0	0.0
Native spp.				
Pseudocheirus peregrinus	0.0	0.0	11.4	5.7
Trichosurus vulpecula and *Trichosurus caninus*	0.0	0.0	6.6	7.6
Rattus fuscipes	0.0	0.0	6.6	8.7
Rattus lutreolus	0.0	0.0	6.8	4.6
Macropus spp.	0.0	0.0	9.7	1.9
Schoinobates volans	0.0	0.0	4.0	1.9
Antechinus spp.	0.0	0.0	0.8	1.9
Sminthopsis spp.	0.0	0.0	0.3	1.9
Perameles nasuta	0.0	0.0	T	1.9
Unidentified	3.0	14.8	7.3	5.7
VEGETABLE MATTER	T	25.9	2.5	52.8
INSECTS	T	14.8	0.8	15.1
BIRDS	T	11.1	5.8	5.7
LIZARDS	T	3.7	1.1	1.9
FROGS	1.0	7.4	0.0	0.0
OTHER ITEMS	6.0	29.6	3.5	26.4
CAT FUR	3.0	14.8	0.2	20.7
HOUSEHOLD SCRAPS	0.0	0.0	3.7	5.7

T = trace

plasmosis. The original spread of this disease is commonly linked with the presence of feral cats. The sexual stage of *T. gondii* can only mature in members of the cat family and the infective oocysts are shed in their faeces (Butler 1979). Subsequently, these oocysts are picked up by grazing animals. This disease, found in sheep and other domestic animals, has also been found in several species of macropods, rodents, bandicoots, possums, dasyurids and in wombats, rabbits and birds (Attwood *et al.* 1975; Gibb *et al.* 1966; Munday 1972, 1978).

The disease can kill infected animals when they are under stress, such as when food is in short supply (Arundel personal communication).

Sparganosis is a disease caused by the larval stage of a tapeworm which is commonly found in feral cats. The intermediate stage of the parasite, called the sparganum, is very common in wild pigs and is also frequently encountered in smaller native animals. Man can get this disease but it is uncommon.

If rabies ever came to Australia, the feral cat could act as a carrier but dog and fox would probably be more important in this regard.

Economic damage

Besides the transmission of various diseases, feral cats appear to cause little or no economic damage in the agricultural situation.

Environmental aspects

It is generally known that feral cats prey heavily on small indigenous mammals and birds in wildlife habitats. It is possible that feral cats may exert a detrimental effect on other small carnivores such as the tiger quoll, eastern quoll and the brush-tailed phascogale (*Phascogale tapoatafa*) by direct competition for food. Certainly, the range and number of some of our smaller indigenous carnivores has decreased markedly since the advent of white man. The impact of predation by cats is difficult to assess, particularly in complex wilderness areas where foxes and feral dogs pose a similar threat. In a relatively simple ecological system on Macquarie Island, cats caused the local extinction of a ground nesting parakeet and it has been computed that the Macquarie Island cat population eats in excess of 50,000 birds per annum (Jones 1977). In areas containing endangered mammal or bird species every effort should be made to eradicate feral cats or limit their numbers.

Control

Although feral cats are not declared vermin under the Vermin and Noxious Weeds Act 1958, they are widely regarded as a pest animal and in some situations such as National Parks and Wildlife Reserves, active control has been attempted. Usually cage trapping has been used, but little research has been done on the effectiveness of this technique. At the moment various trap types and trapping methods are being evaluated.

Cats may be poisoned using 1080 meat baits, but there are probably some hazards to other carnivores. In dense bush areas some success has been achieved by suspending small baits some 500 mm above the ground where raptores and small carnivores have less access.

Like foxes, cats may be killed by shooting in conjunction with night spotlighting. The eyes shine very brightly at night and since the animals are mainly nocturnal in habit this technique can be used with some success.

THE EUROPEAN RABBIT

General

Attempts were made to establish rabbits (*Oryctolagus cuniculus* L.) in Australia right from the commencement of European settlement. Five domestic rabbits were listed amongst the livestock brought by the First Fleet in 1788 (Stead 1935). Rabbits were mentioned in early reports from Fawkner's settlement on the Yarra River at Port Phillip (Rolls 1969). Rabbits were also released on several islands around the Victorian coastline to provide food for shipwrecked sailors (Stokes 1846). The Henty family brought rabbits from Tasmania to Portland, in western

Victoria (Bassett 1954), long before the more well-known episode which followed.

In 1859 about twenty-four wild and domestic rabbits were brought to Melbourne from England and established at "Barwon Park", the property of Thomas Austin, near Winchelsea. Although the details are uncertain, it is clear that these rabbits became established very well indeed.

Of all our introduced mammals, the rabbit has probably had the greatest ecological impact in Australia.

Distribution

Rabbits are found virtually throughout the Australian mainland south of the tropic of Capricorn, in Tasmania and on numerous coastal islands.

Isolated colonies of unknown status occur further north in Western Australia, the Northern Territory and Queensland. Rabbits are found in a wide range of environments including arid stony deserts, sub-alpine valleys, sub-tropical grasslands, wet coastal plains and a wide variety of Mediterranean-type habitats. In Victoria, they occur in habitats associated with nearly all types of land use including areas reserved for conservation purposes.

Breeding

The gestation period is about 28-30 days and mating can occur immediately after parturition.

The kittens are born blind, without fur and in a nest which the doe prepares in a burrow. Young kittens first emerge at an age of about 15-20 days.

Females become sexually mature at about four months of age and males at about five months.

The following generalizations concerning rabbit reproduction are drawn from data collected by the C.S.I.R.O. Division of Wildlife Research from five environments (Myers 1970).

The shortest and most sharply defined breeding season occurs in the sub-alpine region where reproduction is limited to the late spring and early summer months. In Mediterranean-type climates, however, reproduction occurs in most months of the year with a prominent peak in spring.

The average productivity of young per female per year ranged from 13.1 (sub-alpine N.S.W.) to 29.4 (Mediterranean N.S.W.) and the mean numbers per litter (in embyro stage) ranged from 4.49 (arid N.S.W.) to 5.65 (Mediterranean N.S.W.).

In summary, the population in the Mediterranean habitat exhibited a markedly higher capacity for increase — almost twice that of the next highest site (sub-tropical Queensland) and approximately eighteen times that of the lowest site (sub-alpine N.S.W.).

Food and feeding

Rabbits are more selective than sheep in their grazing habits (Myers and Poole 1963; Farrington and Mitchell 1971). Their natural choice is for soft, green grass but when this becomes unavailable they choose food which is easily eaten and masticated, avoiding plants with disagreeable aromatic odours and tastes. In most instances such feeding coincides with a high protein intake. In drought conditions their diet becomes protein and energy deficient and this imposes a considerable stress on the animals.

Diseases

Diseases in wild rabbits are no direct threat to humans. Dogs, however, can become infected with the helminth parasites *Taenia pisiformis* and *Taenia serialis* by eating infected rabbits (Coman 1972a). The cysts of the latter parasite in rabbits are often mistakenly identified as hydatid cysts (Davies and Nicholas 1977). Hydatids has not been reliably recorded in rabbits in Australia.

Occasionally ectoparasites of rabbits are capable of transmitting microbial pathogens to man. The associated diseases include mange, scabies, dermatitis and plague (Yunker 1964; Pegg 1970).

The most famous disease associated with rabbits is the viral disease myxomatosis. Beginning from an experimental site near Corowa in 1950, a spectacular epizootic decimated rabbit populations and for the first time brought rabbits under control (Ratcliffe *et al.* 1952; Brereton 1953). It is expected

that myxomatosis will continue as a moderately severe disease of rabbits for some time to come (Edmonds 1972).

Economic damage

Although generally acknowledged, the economic damage caused by rabbits has not been well documented. However, the real extent of earlier losses was clearly revealed by the enormous increase in wool and meat production which followed the suppression of rabbits by myxomatosis (Reid 1953).

Even though the rabbit problem has been greatly reduced, the resources still required for control demonstrate the continuing economic impact of this species.

Some commercial benefit is derived from the sale of carcasses and skins of wild rabbits, but the commercial production of domestic rabbits is still not permitted in Victoria.

Environmental damage

The impact of rabbits on the Australian environment could well be described as disastrous.

Rabbits have significantly altered the botanical composition of extensive areas of natural habitat. This is mainly because they feed on certain species of plants at critical stages of development such as seeding and seedling establishment (Myers and Poole 1963). These findings have been supported and extended by subsequent studies (Cochrane and McDonald 1966; Churchill 1972).

Because of these ecological changes associated with high population numbers, rabbits have been blamed for the disappearance of the greater bilby, *Macrotis lagotis*, and the pig-footed bandicoot, *Chaeropus ecaudatus*, and for putting many other species under stress. Studies have shown that rabbits have had a drastic effect on the ecology of islands and that significant regeneration of the original vegetation can occur after the removal of rabbits (Norman 1967, 1970).

A further concern is the severe soil erosion which has occurred due largely to the grazing and burrowing activities of rabbits.

The control of rabbits in natural areas without undue disturbance of native flora and fauna presents a major challenge to those who manage land for conservation purposes.

Control

It was not long after the initial rapid spread of rabbits that their threat as a pest species became obvious. By 1869 it had been suggested that rabbit control be made compulsory in Victoria, and in 1880 the Rabbit Suppression Act was drawn up (Rolls 1969).

Today, the main methods of rabbit control are poisoning, fumigation, warren-ripping, harbour destruction, night shooting and exclusion fencing. Biological control through myxomatosis continues to be of great assistance (Edmonds 1972; Tighe *et al.* 1977; Shepherd *et al.* 1978). In recent years the European rabbit flea (*Spilopsyllus cuniculi* Dale) has been introduced as an additional vector of the myxoma virus (Shepherd and Edmonds 1976, 1979).

Advice on the most suitable methods of control in particular situations is readily available from local Inspectors of Lands throughout Victoria and from the Keith Turnbull Research Institute at Frankston.

FERAL PIGS

General

Feral pigs (*Sus scrofa*) in Australia are derived from domestic stock and they have established populations of high density in a wide range of habitats, chiefly in New South Wales, Queensland and the Northern Territory. Some feral pig colonies were established prior to 1870 but most are more recent in origin.

Feral pigs are a declared pest species in Victoria, New South Wales, Western Australia and Queensland. Elsewhere in Australia there is no legislation on feral pigs.

Distribution

Although feral pigs can be found in all States, they are of major significance only in New South Wales, Queensland and the Northern Territory. In New South Wales the greatest density of pigs

is located on the north-western river systems, flood plains and marshes. Populations of up to eighty pigs per square kilometer have been recorded (O'Grady and Hone personal communication).

High population densities also occur in large areas of Queensland but there is no detailed information on distribution.

In the Northern Territory, feral pigs are found only in the north of the State. There, the distribution of pigs is mainly restricted to the river systems.

In Victoria, two main population groupings can be recognized. The majority of animals are found in flood country adjacent to the Murray River in northern Victoria. The other main habitat is in the Eastern Ranges. Smaller colonies are also found is confined situations throughout the remainder of the State.

Breeding

The breeding season of feral pigs in Australia is generally unrestricted.

Sows begins breeding between 6 and 8 months of age if their live-weight exceeds 30 kg. The mean number per litter at birth is 6.5 and the mean number weaned varies from 0 — 4.5 depending on seasonal conditions. Two litters can be weaned in 12-14 months.

Populations of pigs studied in New South Wales have a potential rate of increase of about 300% per annum if resources are not severely limiting. This figure allows for normal hunting pressures.

Food and Feeding

Feral pigs have definite food preferences. Succulent green vegetation forms the bulk of the diet but if this becomes unavailable they become increasingly dependent on plant roots and animal material. Grain crops are particularly attractive even when there is an abundance of green vegetation. The animal tends to be nocturnal particularly during hot weather or when the population is disturbed.

Like domestic pigs, the feral pig has a poor tolerance of high temperature and when temperatures exceed 30°C it must drink water daily.

Disease

The major importance of feral pigs is their potential as a reservoir of exotic diseases particularly foot and mouth disease, swine fever, rinderpest, and trichinosis. This importance is compounded when the distribution of feral pigs is considered, particularly in northern Australia near possible points of entry of diseases from Asia.

Economic damage

Feral pigs cause losses in the pastoral industry and in grain and sugar production. In the pastoral industry the main pig problem occurs during the lambing season particularly in north-western New South Wales. Moule (1954) and Plant *et al.* (1978) have attributed fairly heavy lamb losses in particular flocks in Queensland and New South Wales to feral pig predation. In the investigation by Plant *et al.* (1977), it was estimated that in one season a total of over 600 lambs was killed by feral pigs from 1,422 lambing ewes. Pigs also ruin pastures by grazing and rooting, they break down fences and cause damage to water installations and bore drains.

Pigs have a significant effect on grain production in New South Wales and Queensland. In Victoria crop damage occurs to a lesser extent. Individual farmers may suffer heavy losses from time to time. Losses result not only from consumption of grain and foliage but also because areas of crops are destroyed by trampling. Losses in sugar production are mainly reported from northern Queensland.

Environmental aspects

There is little information available on the effects of feral pigs on the natural environment. Pigs living in forests and swamps can cause considerable damage rooting and wallowing and by spoiling water. There may be a significant effect on ground nesting birds because of damage to nesting sites and habitat. Although studies of pig food habits have not yet indicated predation on wildfowl or eggs, such damage may occur (Giles personal communication). In the high plains of Kosciusko, pigs feed

extensively on tuberous plants and this may cause damage to individual species and plant communities. Furthermore, these disturbances are usually followed by an invasion of weedy exotic plants (Wimbush personal communication). Pigs preying on lambs are likely to prey also on native animals for food. Tufts of hair of possum, koala and kangaroo have been found in droppings of pigs. It is likely that pigs pose a serious ecological problem in many areas and there is a definite need to investigate this possibility.

Control

Useful methods of control are trapping, poisoning and shooting.

Traps are simply small yards constructed of weld-mesh supported by steel fencing posts. Bait is used to attract the pigs into the traps and various devices are used to prevent the pigs from escaping.

For poisoning, pellets or grain are used as bait material. Meat bait injected with poison is also effective.

Shooting is best applied where small populations are restricted to certain watering points or as an ancillary to trapping and poisoning.

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Trout Introduced into South-eastern Australia: Their Interaction with Native Fishes

By P.D. Jackson*

Introduction

The practice of introducing non-indigenous animals into North America and Australasia was particularly characteristic of the 19th Century when people migrated from Europe in huge numbers (McDowall 1968). Fishes were selected by these settlers for those sporting or food qualities thought to be lacking in fishes of the new lands and with no thought to the possible effects of introduced fishes on the native species of fish. Indeed only recently have some biologists questioned the wisdom of introducing exotic species of fish and begun to provide data on the relationships between native and introduced fishes (e.g. McDowall 1968).

In the present paper, the introductions of brown trout *Salmo trutta* and rainbow trout *S. gairdneri* from the Northern Hemisphere into Australia are documented, and the effects of these introduced species on the native fish populations are reviewed.

History of Trout Introductions

Five species of salmonid have been introduced into Australia: the brown trout; rainbow trout; brook trout *(Salvelinus fontinalis);* Atlantic salmon *(Salmo salar);* and quinnat salmon *(Oncorhynchus tshawytscha).* Although populations of all these species still exist in Australian hatcheries, only brown trout and rainbow trout have established self-reproducing populations in the wild.

The introduction of brown trout to Australia is the earliest known introduction of the species beyond its native range in Europe (MacCrimmon and Marshall 1968). Trout ova were first successfully shipped to Tasmania in 1864 after four attempts between 1841 and 1862 (Roughley 1951). Three hundred brown trout were hatched from about 1000 ova and 38 were liberated in the Plenty River. The remainder were retained in the hatchery pond, and their progeny have been used to stock the rivers of Tasmania and mainland Australia.

Rainbow trout were first introduced in 1894 (Roughley 1951) when fertilized ova were transferred from New Zealand to New South Wales. The species had been introduced to New Zealand from their native range on the Pacific coast of North America in 1883.

Biology and Present Distribution of Trout in South-eastern Australia.

Brown trout is a thick-bodied, streamlined species known to reach at least 900 mm in length and 14 kg in weight in Australia (McDowall 1980). It occurs most commonly in cool (upper lethal temperatures occur between 22.5 and 25.3°C according to Frost and Brown 1967) and well oxygenated waters of both rivers and lakes. However it requires clear, flowing water and a gravel substrate for reproduction. Eggs are deposited in depressions in the gravel in late autumn to winter (May to August). Recently hatched young initially form shoals in shallow fast-flowing sections of river but soon become solitary and strongly territorial. Brown trout are carnivorous, feeding on a variety of invertebrates and small fishes.

Rainbow trout is similar in shape to brown trout and reaches about 775 mm in length and 8 kg in weight in Australia (McDowall 1980). Its biology is essentially similar to brown trout. Rainbow trout may spawn a little later and tend to be more successful in lakes than rivers. Where the two species occur together brown trout dominates.

As the biology of brown and rainbow trout is essentially similar, previous Australian authors (e.g. Weatherley and Lake 1967, Tilzey 1977) have grouped

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them together under the single heading 'trout'. The same convention is followed here except where specific examples are given.

Trout were first introduced into rivers and lakes by acclimatisation societies. To quote Tilzey (1977), "Such was the zeal of early acclimatisationists that trout were introduced into most suitable river catchments before 1900". Later, and with equal fervour, the State fisheries departments continued stocking streams, lakes and reservoirs with trout. Trout are still reared in government hatcheries and many waters are still stocked regularly. The success of such stockings is debatable. The survival rate of trout in streams already containing wild trout is very low. Nicholls (1958) showed that in a Tasmanian stream only about 2% of hatchery-released fish reached the age of 3 years. Lake (1957) found the situation to be similar in New South Wales waters. Recently, Cadwallader and Tilzey (1980) have questioned the wisdom of stocking many of the reservoirs in Victoria and New South Wales, particularly those below 900 m in altitude, where mortality rates are often high and returns to anglers low.

Due to the spawning requirements and temperature tolerances of trout, self-reproducing populations now occur mainly in streams of the south-eastern highlands of mainland Australia, at altitudes above about 600 m and in most highland streams in Tasmania (Fig. 1). Sound arguments for the success of trout in the Australian environment are reviewed by Weatherley (1974) and Tilzey (1977). Briefly, the main reasons according to Tilzey (1977) are: the physicochemical and biological similarities between certain Australian waters and the trout's ancestral waters, the availability of food, the virtual absence of parasites and diseases, and minimal competition from native fishes (see below).

The distribution of trout is still expanding because weirs and impoundments provide cool waters which enable trout to survive in streams where summer water temperatures would normally be lethal to them. Water released from

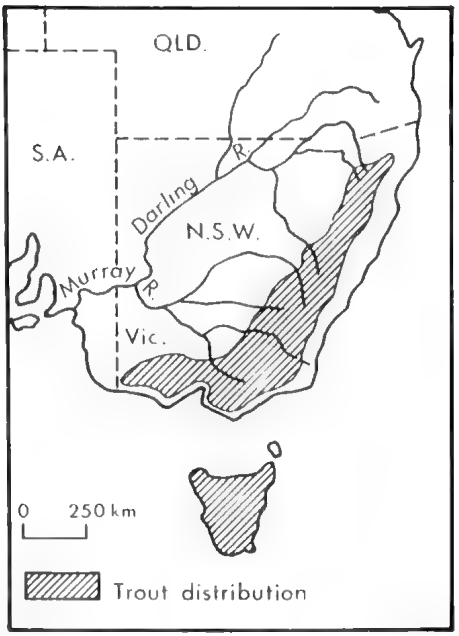

Fig. 1. Distribution of trout in South-eastern Australia.

deep impoundments during summer can be as much as 11°C colder than ambient water temperature, which it may not rejoin for up to 100 km (Buckmaster *et al* 1979). It may be noted here that such alterations of temperature and flow regimes have markedly depleted native fish stocks (Cadwallader 1978).

Interaction with Native Fishes

Whilst a decline in numbers and distribution of native fishes is widely acknowledged (Frankenberg 1966, Lake 1971) opinions are divided as to the reasons. Some (e.g. Weatherley and Lake 1967, Lake 1971) have contended that man-made changes to the environment, for example, alterations to the hydrological regimes of rivers, clearing of snags, pollution and so on have been the main factors. Others (e.g. Frankenberg 1966, Jackson 1975, Tilzey 1976), whilst acknowledging that man's modifications of the environment have had a deleterious effect on native fishes, have maintained that the effects of fish introductions have also been considerable. In the present paper the detrimental effect of environmental

modifications other than the introduction of trout is accepted, and the discussion is limited to a review of the evidence of interactions between trout and native fishes.

Table 1 lists the most common native species recorded from tableland waters above 600 m on the mainland and from what are now considered the trout waters of Tasmania. Of these, only river blackfish, Macquarie perch and galaxiids have been reported to spawn in such waters. Murray cod, tupong, Australian and Tasmanian smelt and pigmy perch inhabit these waters only occasionally, generally occurring further downstream.

Thus of the native species that attain a moderate size, only five are found in what are now trout waters; short-finned eel, long-finned eel, river blackfish, Australian grayling and trout cod. Both species of eel are piscivorous (Beumer 1979). Butcher (1945) found river blackfish to be mainly insectivorous and Jackson (1978a) concluded that fish did not form a significant part of the river blackfish's diet. The Australian grayling is probably omnivorous, feeding on insects (Jackson 1976) and on algae (Bishop and Bell 1978). Consequently introduced trout were probably preyed on by few indigenous fishes other than eels. Murray cod and tupong have been reported to eat fish (Lake 1971, Nicholls 1958) and may have preyed on trout in waters at lower altitudes (Tilzey 1977).

This comparative lack of indigenous piscivorous fishes has probably led to several species being highly susceptible to predation, through not having evolved or retained predator escape mechanisms (Tilzey 1977). When trout were introduced into rivers, native fishes were freely available to them as prey and trout had little competition from larger native fishes.

Frankenberg (1966) was the first to comment on the fragmented distribution of galaxiids and to suggest that this was due to trout. Specifically he cited the headwaters of the Kiewa river where trout occupied the main body of the stream and galaxiids occupied places inaccessible to trout, such as above waterfalls. However, there are very few data on the relationships between trout and galaxiids in general. Evidence is strong for only one species, the mountain galaxias *(Galaxias olidus).*

The mountain galaxias is a small species, reaching only about 10-13cm in length (McDowall 1980), with a widespread, if fragmented distribution in highland streams. It is most commonly found in small headwater tributaries where it occurs in loose shoals in pool areas or solitarily amongst rocks in more shallow areas. It is largely insectivorous

Table 1. **Native Fishes occurring in Trout Waters in Australia**

Common name	Scientific name	+ Maximum recorded length (mm)
•River blackfish	*Gadopsis marmoratus* Richardson	625
•Short-finned eel	*Anguilla australis* Richardson	900
•Long-finned eel	*Anguilla reinhardtii* Steindachner	1500
Macquarie perch	*Macquaria australasica* Cuvier and Valenciennes	370
Trout cod	*Maccullochella macquariensis* (Cuvier and Valenciennes)	685
Murray cod	*Maccullochella peeli* (Mitchell)	1800
•Australian grayling	*Prototroctes maraena* Gunther	300
•Tupong	*Pseudaphrites urvilli* (Cuvier and Valenciennes)	300
Silver perch	*Bidyanus bidyanus* (Mitchell)	400
•Galaxias spp.		
e.g. Mountain galaxias	*Galaxias olidus* Gunther	130
Climbing galaxias	*G. brevipinnis* (Gunther)	278
Spotted mountain galaxias	*G. truttaceus* Valenciennes	200
Australian smelt	*Retropinna semoni* Weber	100
•Tasmanian smelt	*Retropinna tasmanica* McCulloch	67
•Pigmy perch	*Nannoperca australis* Gunther	82

+ Measurements taken from McDowall (1980)
• Occurring in Tasmanian trout waters
(All species apart from *R. tasmanica* occur on the mainland)

feeding on both aquatic and terrestrial insects and appears to spend its entire life cycle in freshwater (Fletcher 1979).

Jackson and Williams (1980), in a study of the distribution of brown trout and native species in the upper reaches of the Yarra River, showed that mountain galaxias were present only in those tributaries where brown trout were absent. Furthermore, in many small tributaries trout were the only fish present, suggesting the elimination by this species of all native fishes. There is no evidence to suggest that such habitats cannot support native fishes.

Other authors (e.g. Tilzey 1976, Cadwallader 1979, Fletcher 1979) have also documented the mutually exclusive distributions of trout and mountain galaxias in highland streams on mainland Australia. Tilzey (1976) was able to document the invasion by rainbow trout of a small stream flowing into Lake Eucumbene, New South Wales. In 1971 the stream contained only mountain galaxias upstream and downstream of a waterfall. By 1974 rainbow trout had invaded the section downstream of the waterfall and were the only fish present. The mountain galaxias population upstream of the falls was similar to that present in 1971 suggesting that the presence of rainbow trout was the sole environmental factor causing the disappearance of mountain galaxias.

Fletcher (1979) has attempted to further investigate the interactions between trout and mountain galaxias by experimentally introducing brown trout into an enclosed section of Watchbox Creek, Strathbogie Ranges. Both the experimental and a control section contained only mountain galaxias of similar numbers and size range at the commencement of the experiment. After four months, the galaxias population in the experimental section was considerably depressed, both in terms of numbers and weight, in comparison with the control section.

There is thus growing evidence to suggest that trout is incompatible with mountain galaxias. The mechanisms of this negative interaction are not clear. Certainly, the two species show considerable overlap in diet (Fletcher 1979) and competition for food must occur. Furthermore, mountain galaxias feeds on the bottom and in the water column in a similar manner to trout and direct competition, where there is direct contact between individuals of the two species, may occur. Trout may therefore inhibit the mountain galaxias from feeding. Mountain galaxias also occurs in the diet of trout (Bishop and Tilzey 1978, Fletcher 1979) and direct predation may be an important factor. Fletcher (1979) has suggested that the mountain galaxias lacks any predator avoidance mechanisms but more work is needed to determine this fully.

The relationships between trout and other galaxiid species are much less clear. There is some evidence to suggest that the distribution of the climbing galaxias *(G. brevipinnis)* has been affected by trout (Andrews 1976, Jackson and Williams 1980). The only known locality of the Swan galaxias *(G. fontanus)*, a recently described species from Tasmania, is above a waterfall barrier which separate the population from brown trout (Fulton 1978).

Data are few on the relationships between trout and native fishes other than galaxiids. Jackson (1978a) has discussed the relationship between brown trout and river blackfish, a species that appears able to co-exist with trout, (Frankenberg 1974, Jackson and Williams 1980). Although the diets of the two species are very similar they may avoid direction competition because the two species occupy somewhat different habitats, river blackfish preferring the slower-flowing stretches of river. The decline of river blackfish in recent years may, at least in part, be explained by the de-snagging of rivers because the species spawns in submerged hollow logs (Jackson 1978b).

The short-finned eel also appears able to co-exist with trout (Jackson and Williams 1980). Although there are no data on the relationship between trout and eels in the Australian environment, considerable research done in New Zealand, where short-finned eels also occur (e.g. Burnet 1968, 1969, Hopkins 1970, Skrzynski 1974) has shown that the relationship is complex and varies

from river to river. However, there was no evidence to suggest that the introduction of trout had been detrimental to eel stocks; in fact some evidence was presented to show that the removal of eels from a section of river may lead to an increase in the number of trout. Studies of feeding habits (Burnet 1968) showed that larger eels did include trout in their diet.

The relationships between trout and any of the other native species, Macquarie perch, Australian grayling and trout cod, are difficult to ascertain because all three are now rare and few biological studies were made when these fishes were much more abundant.

Macquarie perch were once common in the upper reaches of the Murray-Darling System but their distribution and abundance is now greatly reduced (Cadwallader 1977, 1978). Macquarie perch and trout have similar diets (McKeown 1934, Butcher 1945). Adult Macquarie perch in aquaria obtain food by a sucking action and normally attempt to take only items within their immediate vicinity (Cadwallader and Eden 1979). Examination of the stomach contents of Macquarie perch collected from the wild indicated that they are basically bottom feeders which obtain only a small portion of their food at the water surface. As such they are less aggressive feeders than trout which seize their prey and feed in the water column as well as on the bottom (Frost and Brown 1967). Therefore Macquarie perch may not have been able to compete successfully with trout for food. Furthermore trout eat small Macquarie perch (Butcher 1967).

Australian grayling were once common (Tunbridge 1972) and often taken by anglers, but even early this century the species was rare in New South Wales and although once exceedingly plentiful in the Yarra River, Victoria, had become very scarce (Stead 1903). Since that time their numbers have continued to decline. Recent surveys undertaken by the fisheries departments of New South Wales, Victoria and Tasmania have located several previously unrecorded populations but the species must still be regarded as rare. The reasons for its decline are unknown, but its disappearance corresponds closely with the introduction of trout and with man's concurrent modifications to the stream habitat. In particular, the damming of rivers must be detrimental to the Australian grayling which is probably anadromous (spends part of its life cycle at sea and migrates to freshwater to spawn) and needs an unrestricted passage up and down the river systems it inhabits.

Trout cod were formerly found in many waters throughout the Murray-Darling River system (Berra 1974), but are now collected consistently in only one stream, Seven Creeks, a small tributary of the Goulburn River near Euroa, Victoria. Although little is known of the biology of the species, Cadwallader (Fisheries and Wildlife Division, pers. comm.) believes that the introduced trout have had a detrimental effect on trout cod, particularly in north-eastern Victoria where trout now dominate streams previously the domain of trout cod. Cadwallader's (1978) observations of young (1-6 months old) trout cod in aquaria indicate that the species establish territories in a similar manner to trout, and field observations indicate that both species have similar habitat requirements. What little data are available on the food of trout cod indicates an overlap with the diet of trout.

Conclusions

With few exceptions, information on the relationships between trout and native fishes is fragmentary and inconclusive. So little is known about the biology and previous distribution of native fishes that it is difficult to say exactly what the effects of trout have been. Perhaps one of the most obvious detrimental effects is that until recently, the resources of State fisheries departments were channelled only in one direction and at the expense of research of native fishes. Consequently little work was done on native species when they were still abundant.

Although information on the relationships between trout and native species is scarce, clearly the mountain galaxias is particularly susceptible to displacement by trout. Galaxiids appear to be suscep-

tible to displacement by predatory game fish throughout their natural range. McDowall (1968) concluded that trout were incompatible with several New Zealand galaxiids, and Jubb (1965) reported that populations of South African species of galaxiids had been detrimentally affected by the introduction of predatory game fish. No data are available from South Ameria where trout have been introduced into waters where galaxiids occur.

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Introduced Non-marine Molluscs in Australia

By
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Terrestrial molluscs are probably the best known invertebrate animals introduced into Australia. The majority of snails and slugs with which most people are familiar in southern Australia are species introduced into Australia, mainly from Europe. These were almost all accidental introductions on tools and machinery or on plants being brought over by the early European settlers. Several of the species are now very widespread throughout most of temperate southern Australia, inhabiting mainly the man-modified environments dominated by introduced vegetation. A few species appear still to be actively spreading largely as a result of changing patterns of agriculture and transportation.

Lists of introduced molluscs in Australia have been given by Musson (1890), Gabriel (1930), Cotton (1954) and Smith and Kershaw (1979). Thirty-five species are here recognised (see Appendix) as having been introduced into Australia by European man. Several others may be well established here but remain unrecognised while others are about to be introduced and distributed. This is particularly likely with respect to tropical species.

Most introduced species of non-marine mollusc can be considered noxious animals being either pests of gardens, crops or pasture, or vectors for stock disease. Thus far no snail-borne human diseases have been found being infective in Australia, except reports of schistosomiasis in northern Australia during World War II, but the possibility remains with each fresh introduction. Many of the species have proved to be highly successful world travellers having colonized most temperate regions of the world in the last two or three centuries.

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Fresh Water Snails

Four species of freshwater snails belonging to three families are considered established introductions. These were probably brought in on aquatic plants with importations of live fish. Several other species, mainly tropical, are confined to aquaria with no reports of "wild" populations. Only one species, *Physa acuta*, appears to be at all widespread. The species has only recently been recognized as a common freshwater faunal element in southern Australia, it being confused in the past with native species of *Physastra* and *Isidorella*. It appears to prefer still to slow flowing freshwater with plenty of aquatic vegetation and is tolerant of turbid and moderately eutrophic conditions.

An important recently recorded introduction (Ponder, 1975), is the lymnaeid *Pseudosuccinea columella*. This is reported to be a more potent vector of

the economically important sheep liver fluke, *Fasciola hepatica*, than the native lymnaeid *Austropeplea tomentosa*. It has been recorded from aquaria in Perth, Sydney, Melbourne and some regional centres and seems to be established in the wild in isolated pockets in these centres. Orginally a native of North America, it may have been introduced into Australia from New Zealand.

Land Snails

Twenty-one species of land snails belonging to eight families are listed as introductions into Australia. Several remain very localized and insignificant in the environment of long established suburban gardens. Two or three species of the genus *Oxychilus*, the glass snails, can even be described as beneficial as they feed on non-green vegetable matter or on small animals such as insect larvae or pest species of molluscs. However one family, the Helicidae, contains several species which are common, widespread pests of gardens and crops, often occurring in very large population densities.

Helix (Cryptomphalus) aspersa, the common Garden Snail, and *Cochlicella ventrosa*, the Small Conical Snail, have a very widespread distribution throughout the moister areas of southern Australia. *Helix* is mainly a garden and orchard pest feeding on leaves and fruit of ornamental and crop species. *Cochlicella* is found in these areas and is also important as a pest of pasture grasses in certain areas. The Sand-Dune Snail, *Theba pisana* occurs in very high population densities along many sections of the coastal areas with some centres being established inland, such as along the River Murray. This is also spreading to become a garden pest in some areas. A snail similar in appearance, the White Snail, *Cernuella (Cernuella) virgata* occurs in large populations in South Australia and Western and Central Victoria where it has become an important wheat contaminant pest.

Most of the helicids appear to be adversely affected by higher mean yearly temperature conditions, the effect probably being most marked on the reproductive biology. Untested observations suggest that these snails require cool wet conditions for breeding and subsequent survival of the juvenile snails. If the main wet season occurs in conditions of high temperatures, this combination may not be as favourable for successful breeding. Garden helicids appear to be being replaced in Northern New South Wales by a bradybaenid, *Bradybaena similaris* from Asia.

A potentially very important pest introduction, *Achatina fulica* the Giant African Snail, has been threatening to establish a firm foot-hold in Australia for some time. Isolated populations were reported in the Cairns area of North Queensland a few years ago (Colman, 1977) and many live specimens are intercepted by quarantine officers at ports of entry every year. There seems no valid reason why *Achatina* should not eventually become established in the wetter tropical and subtropical areas of Australia in the future.

Slugs

The most widespread and most severe pest species of introduced non-marine molluscs are to be found in the slug family Limacidae. Three of the five species in this family, *Deroceras reticulatum*, *D. caruanae* and *Lehmannia (Lehmannia) nyctelia* are the most common and widespread living-plant feeders in the Australian terrestrial mollusc fauna. The other two limacid species, though not nearly as common, are conspicuous members of the fauna because of their large size (Altena and Smith 1975). The pest species *Milax gagates* and the marginal to non-pest species *Arion intermedia* are also very widespread in southern Australia with *Arion intermedia* probably penetrating farther into unmodified native bush areas than any other species of introduced mollusc. The beneficial carnivorous slug *Testacella* is very rare with only a few specimens having been recorded.

Slugs, because of their lack of shell and ability to enter and lie hidden in very small spaces, are particularly difficult to exclude from machinery and packaging, thus facilitating their rapid infestation of remote areas.

Discussion

Over the two hundred years or so of European settlement of Australia non-marine molluscs must have been accidentally introduced into various areas many thousands of times. These introductions occurred from widely geographically separated gene pools resulting in complex character recombinations within one species. This has made the identification of introduced species in Australia an almost impossible process in many cases as the "parent" species to which these introductions should be referred are themselves incompletely known taxonomically. Many of the characters used to separate closely related species in Europe are linked in identification keys to geographical features. These keying characters are of little value when considering an introduced species.

Of the many species that have undoubtedly been brought into the country only certain ones have survived to breed and become established. The large common garden slug of Britain, *Arion ater*, has been recorded as an introduction many times. However no established populations are known to the writer anywhere in Australia. Other species possess in their genetic make-up, the flexibility to make of themselves successful world travellers capable of establishing vigorous populations in most temperate regions of the world.

Very few tropical or subtropical species are included on the list of introductions. This is mainly due to the lack of knowledge of the native tropical non-marine mollusc fauna of Australia, making it almost impossible to decide which species are here as part of their natural widespread geographical distributon and which are here as a result of the activities of man within the region. The only documented introduced tropical snail is *Achatina fulica*, whose progress across the world has been comprehensively reported (Mead, 1961).

Most introduced species have a distribution across native faunal region boundaries (Smith and Kershaw, 1979). In highly man-modified regions, such as many parts of south eastern Australia, they are the dominant group of non-marine molluscs. In most cases there is strong evidence that their distribution is continuing to increase with species being currently recorded as pest species in localities where only a few years ago they were entirely absent. This trend is being accelerated by the increased land clearing for crop monoculture coupled with the rapid transport of products of that process across great distances. This same facility of rapid transport is also increasing the risk of new introductions into Australia. Some of these introductions are accidental such as the inadvertent introduction of aquatic snails such as *Pseudosuccinea columella* on plants imported with live fish for aquarists. Others are deliberate, such as the smuggling of live edible Roman snails *Helix pomatia* to set up illicit culture projects for sale to fashionable restaurants.

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Appendix

List of species of non-marine molluscs introduced into Australia by man during the last two hundred

years. Species of actual or potential major economic importance are marked with an asterisk (*).

Family Lymnaeidae
Lymnaea stagnalis (Linnaeus, 1758)
**Pseudosuccinea columella* (Say, 1817)
Family Planorbidae
Planorbarius corneus (Linnaeus, 1758)
Family Physidae
Physa acuta Draparnaud, 1805
Family Cionellidae
Cionella lubrica (Muller, 1774)
Family Valloniidae
Vallonia pulchella (Muller, 1774)
Family Ferussaciidae
Ferussacia folliculus (Gmelin, 1790)
Family Achatinidae
**Achatina fulica* (Ferussac, 1821)
Family Arionidae
Arion intermedius Normand, 1852
Arion hortensis Ferussac, 1819
Arion ater Linnaeus, 1758
Family Zonitidae
Oxychilus cellarius (Muller, 1774)
Oxychilus draparnaldi (Beck, 1837)
Oxychilus alliarius (Miller, 1822)
Vitrea contracta (Westerlund, 1873)
Vitrea crystallina (Muller, 1774)
Zonitoides arboreus (Say, 1816)

Family Limacidae
**Deroceras reticulatum* (Muller, 1774)
**Deroceras caruanae* (Pollonera, 1891)
**Lehmannia (Lehmannia) nyctelia* (Bourguignat, 1861)
**Lehmannia (Limacus) flava* (Linnaeus, 1758)
Limax maximus Linnaeus, 1758
Family Milacidae
**Milax gagates* (Draparnaud, 1801)
Family Euconulidae
Euconulus fulva (Muller, 1774)
Family Testacellidae
Testacella haliotidea Draparnaud, 1801
Family Bradybaenidae
Bradybaena similaris (Ferussac, 1831)
Family Helicidae
Cochlicella acuta (Muller, 1774)
**Cochlicella ventrosa* (Ferrussac, 1821)
**Helix (Cryptomphalus) aspersa* (Muller, 1774)
**Theba pisana* (Muller, 1774)
Eobania vermiculata (Muller, 1774)
**Cernuella (Cernuella) virgata* (da Costa, 1778)
Cernuella (Xerocincta) neglecta (Draparnaud, 1805)
Cernuella (Microxeromagna) vestita (Rambur, 1868)
Candidula intersecta (Pioret, 1801)

The Effects of Introduced Aquatic Plants in Australia

BY HELEN I. ASTON†

Of approximately 200 aquatic fern and flowering plant species growing in the wild in Australia about 20, i.e., about 10% are naturalized introductions. Although the number of introduced aquatics is small their impact on the Australian scene is considerable. They have no beneficial qualities which are not supplied equally as well by native species, yet several have proved excessively detrimental, becoming major weeds with severe environmental, social and economic effects. Weed species have displaced native aquatics, become aesthetically displeasing, reduced water purity by deoxygenation and eutrophication, altered evapotranspiration rates, reduced water flow in irrigation channels and rivers by up to 70%, reduced the carrying and storage capacity of water bodies, blocked engineering works such as locks and floodgates, prevented swimming and boating, fouled pasture after floods, caused loss of agricultural production particularly in irrigation areas with crops such as rice, harbored the vectors of disease or nuisance insects such as mosquitoes, forced authorities into the extensive use of herbicides, and absorbed large quantities of public finance in control programmes. In 1978 the estimated cost of aquatic weed control in Australia was 2½ - 3 million dollars.

In view of the proven detrimental effects of a number of naturalized introductions (particularly *Eichornia crassipes*, Water Hyacinth; *Salvinia molesta* Salvinia; *Elodea canadensis* Canadian Pondweed, Elodea; *Sagittaria graminea* Sagittaria; *Alternanthera philoxeroides* Alligator Weed and *Myriophyllum aquaticum*, Parrot's Feather) it is advisable to prevent the introduction of any further aquatic species into this country without due forethought as to their weed potential. It is also advisable to prevent any further extension of those introduced aquatics which are already in Australia into areas outside of aquaria and backyard ponds. Control and/or eradication of aquatic

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weeds requires the development of uniform laws on noxious weeds and trade, education of field officers and the public to encourage discovery and reporting of new infestations, monitoring and assessment of control measures, and research into the total ecology of aquatic ecosystems including biological control of particular species.

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Boneseed in the Bushland of Victoria

BY D. LANE†

Boneseed *(Chrysanthemoides monilifera)* was introduced into Australia from South Africa and was cultivated in most states as a garden shrub and on occasions, used to stabilise sand dunes. An ability to grow in bushland soon became evident and examples of occurrences of escapes from cultivation are listed in Grey (1976). In Victoria, extensive infestations of boneseed occur in coastal areas on the Mornington Peninsula and between Geelong and Apollo Bay. In dry woodland extensive infestations occur at Arthurs Seat, the You Yang Mountains and on the eastern outskirts of Melbourne (Fig. 1). Scattered infestations, usually in the vicinity of towns, occur throughout the state (Parsons, 1973).

Boneseed has not been alone in invading areas of Australian bushland. Many species e.g. blackberry (*Rubus fruticosus* agg.), Pines (*Pinus* spp.) Polygala (*Polygala myrtifolia*) Tutsan (*Hypericum androsaemum*), flat weeds (*Hypochoeris* spp.) and numerous grasses have been similarly invasive. Nor has the establishment of exotic species been all one way. Australian *Acacia* spp. and *Hakea* spp. have spread in South Africa and *Eucalyptus* species are becoming widespread in California.

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In this article, boneseed will be discussed as an example of an exotic which can invade native plant communities and an approach to the control of this species will be outlined. A successful invader, either a native or an exotic species, must produce seeds (or other reproductive parts) which can be readily disseminated and able to establish in new habitats. Boneseed, selected because of prolific flower production, sets a large number of seeds each year. These have a hard seed coat and a fleshy outer covering. When ripe, the fruits are eaten by some animals, e.g. foxes or birds, and this provides an effective means of spread into bushland. The seeds are large and the seedlings exhibit both a rapid initial growth and an ability to withstand shading, infertile soils and moisture stress.

In South Africa, boneseed is a vigorous and successful species which has evolved into six sub species (Norlindh, 1943) that occupy habitats throughout the country. Hutchinson, (1946) refers to boneseed as "an amazing species both as regards variation, choice of habitat and distribution . . . which grows in abundance from sea-level on the Cape Peninsula right around the east coast to as far north as Usambara in Tanganyika Territory; it climbs to the top of the Khamiesberg and the Karee Bergen in the west, and well up the slopes of the Mont aux Sources on

the Drakensberg . . . The Species attains its fullest development on shale near the coast".

This inherent vigour, combined possibly with an absence of natural pathogens in Australia, is doubtless the basis of the success of establishment of boneseed. While it is popular to believe that the Australian native species are best adapted to their environment and would therefore have a competitive advantage over exotic species, it appears that this may not be completely true. Evolution of native species has occurred in isolation, with low grazing pressures from native animals under climates which differed from today's. As well, variability in the environment occurs from year to year and long lived species have had to adapt to survive the extremes. Any community, also, is not composed of adult individuals fully exploiting all available resources but is a balance between ageing plants and establishing replacements. In combination, these three factors suggest that the native communities will have spaces in space and time that can be occupied by exotic species. In the case of boneseed, the available niche is a layer beneath the tree and tall shrub canopy and above the grasses and herbs.

The Growth of Boneseed in Bushland

Boneseed does not appear to have any specific requirements for germination once the seed coat has cracked. Seedlings establish at any time of the year but particularly in autumn and spring or following clearing or fires. Seedling survival is reduced in moist, shady situations, etiolated plants being more susceptible to fungal attack. Seedlings do survive beneath mature boneseed plants so an established infestation is maintained and does not represent a temporary phase in community development. Mature boneseed forms a very dense canopy which excludes smaller plants, e.g. grasses and herbs, and the seedlings of trees and shrubs. This alters the composition and character of bushland and can threaten the existence of some native species. This density can be achieved because boneseed is free from competition from similarly sized native species and has few parasites or pathogens.

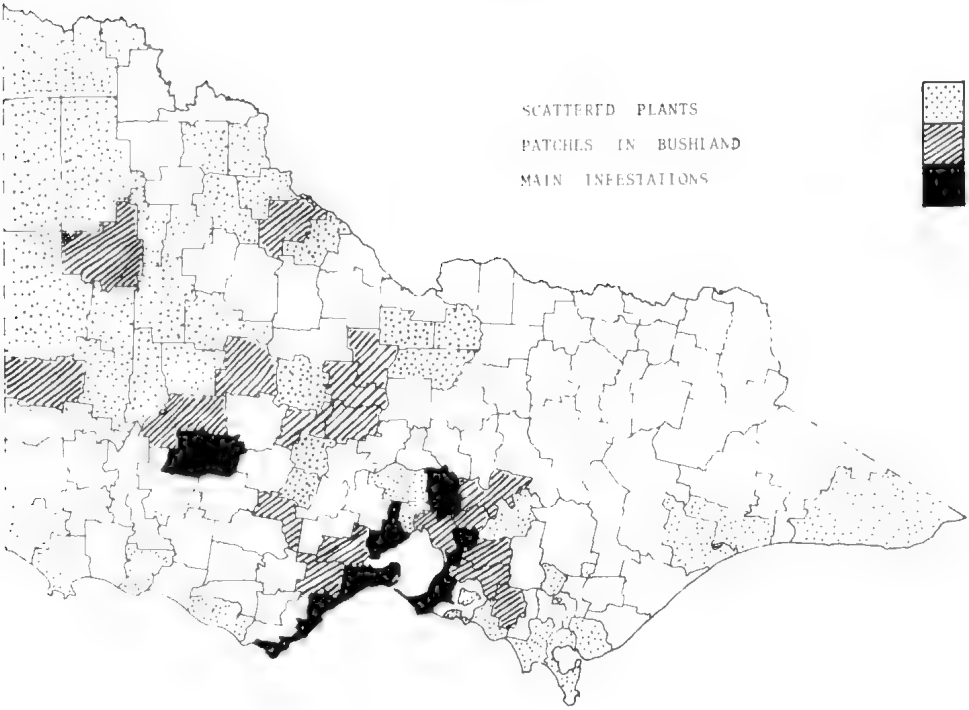
The Spread of Boneseed

While areas such as Arthurs Seat and the You Yangs carry extensive infestations, most boneseed is restricted to bushland in the vicinity of settled areas. This indicates that natural spread is slow since many areas of Victoria have similar soils, climate and vegetation to the affected sites. A major barrier to the spread of boneseed is agricultural land since seedlings do not survive grazing or cultivation.

Control of Boneseed

The control of a plant, such as boneseed, in bushland poses difficult and unique problems. Most weed control is based on altering the environment in which the weed is growing to suppress re-establishment once the existing plants have been removed. In agriculture, cultivation or grazing programmes can be changed or competitive species established, with the use of fertilizers. Where the weed growth cannot be suppressed, repetitive control measures have to be resorted to. In bushland, the options of changing the environment or introducing competitive species are not available and repetitive treatment is often beyond the scope of resources or damages the native species. Biological control can reduce dense infestations to scattered plants. However, effective pathogens which are specific to the weed species have to be available and such organisms have not been found for boneseed. For boneseed, a characteristic of the seed germination has been used to develop an effective method of control of dense infestations. Exposure to heat (100°C for 30 seconds) has been found to stimulate virtually complete germination of all seed, provided the seed coat is cracked (Lane & Shaw, 1978). The seed coats develop three cracks while lying in the soil and all fruits which fall to the ground in January to February have cracked by September-October. Seeds within the cracked coats can germinate, however the rate is slow and only about 4% will germinate within one month in

Fig. 1 BONESEED DISTRIBUTION 1976



the laboratory. After heating, however, over 90% germination can occur in the same period.

In the field, a slow, cool burn provides suitable conditions to stimulate germination. Plots cleared after a bushfire at Arthurs Seat in 1973 and following experimental burns at the You Yangs have remained free of boneseed once seedlings which established immediately after the burn were destroyed. The seedlings can be removed by hand or by herbicides. One herbicide, bromoxynail, at a rate of 1:600 will kill boneseed seedlings but not harm grasses or *Acacia* species which also germinate after a burn. This herbicide has no residual effect in the soil so permits re-establishment of native species on treated areas.

In developing control programmes for exotics such as boneseed, treatments must be sympathetic to the native flora. At the same time however, the existing and potential threat of the exotic species to the survival of the natives must be remembered. The removal of established exotics invariably requires work that will damage existing native plants. The benefit comes from ensuring that the native community is able to regenerate by reshooting and the establishment of seedlings.

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The Rehabilitation of Weed Dominated Communities

BY F. D. PANETTA*

Introduction

There are numerous instances in Australia where areas modified to a greater or lesser extent by man's activities have been invaded and subsequently dominated by exotic plant species. Two species which have been particularly successful in this regard in Victoria are blackberry *(Rubus fruticosus* agg.) and boneseed *(Chrysanthemoides monilifera).* Such species appear to be capable of preventing the regeneration of native shrub and tree species and may persist locally for an indefinite period of time.

This paper seeks to examine issues related to the rehabilitation of weed dominated communities and attempts to highlight aspects which warrant further investigation. Three broadly interrelated areas will be dealt with, *viz.* rehabilitation aims, rehabilitation strategy and the selection of replacement species.

Rehabilitation Objectives

The aims of any rehabilitation effort should be clearly defined at the outset. It must be kept in mind, however, that the present understanding of vegetation processes and the degree of development of skills involved in the management of vegetation are sufficiently rudimentary to pose problems concerning the realization of such aims.

A primary objective should be to determine the desired floristic and structural attributes of the rehabilitated community. The establishment of a monoculture of *Pinus radiata* is one method of displacing blackberry and other troublesome weeds, but may not find much support among the general public. The establishment of plantations of *Eucalyptus* spp. may be marginally more acceptable. If the rehabilitated community is to be considered as a habitat for native fauna, an exotic monoculture may be undesirable (Barnett *et al.,* 1976, Disney and Stokes, 1976). Perhaps the rehabilitated community should resemble the aboriginal vegetation as closely as possible.

A useful guideline for decision making at this stage may be provided by patterns of present and projected land use. If the area under consideration is marginally productive agricultural land it may be acceptable to establish a *Pinus* or *Eucalyptus* monoculture. Alternatively, if the weed dominated communities are presently found in areas which have importance as reserves or recreational facilities, the desired floristic and structural attributes of the rehabilitated community may closely resemble those of the native community prior to the invasion by exotic plant species.

If the aim is to establish a native monoculture, one would simply require a species which could be expected to be successful under the prevailing environmental conditions. The selection of such a species could follow from the examination of either local remnant communities or historical records.

If it is desirable to establish a more complex community, e.g. a mixture of two or more species, possible interactions between the species must be considered, both in the initial establishment phase and as they relate to the persistence of the community through time. Noble and Slatyer (1977) have recently attempted to explain the vegetation dynamics of Australian plant communities on the basis of a few attributes of pairs of dominant species.

The first attribute concerns the method of recovery of a species after disturbance. Such methods include

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recovery by means of vegetative regrowth (V), a local seed pool (S), immigration of highly dispersable seed (D) or no special mechanism for recovery (N). (It should be noted with regard to the first two methods of recovery, however, that not all species are purely V or S; many species display a mixture of both methods).

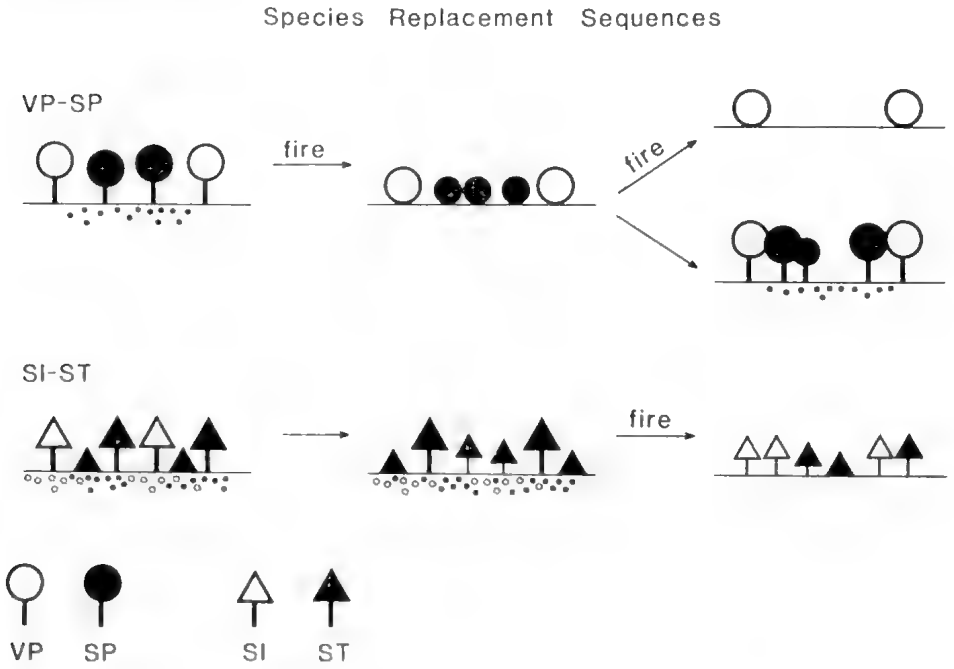
The second attribute concerns the ability of a species to reproduce in the presence of competition from individuals of either its own or another species. Species can thus be characterized as being either tolerant (T), partially tolerant (P) or intolerant (I) of such competition.

These two vital attributes may be seen to be complementary to a certain extent. If a relatively high frequency of disturbance, e.g. fire, is a controlling factor in the development of a community, then mechanisms of recovery from disturbance are likely to be important contributors to the persistence of species. Conversely, if the intervals between disturbance events are long relative to the life span of individuals then an ability to reproduce in the face of competition is likely to be favoured.

If a species mixture is to be stable, it is essential that one species does not replace the other(s) under disturbance regimes which the rehabilitated community might be expected to experience. There are a number of possible combinations of vital attributes which may ensure the stability of a species pair, just as there are a few combinations which are unlikely to persist. For example, VT-VT and VP-ST species pairs are likely to produce stable communities, whereas VT-NP and VP-NI species pairs are likely to be dominated eventually by the first member of the pair. Where one member of the rehabilitated community is an obligate seed reproducer, successive fires at intervals shorter than the time to reproductive maturity are likely to eliminate it (Fig. 1). A certain level of protection from fire may be necessary to ensure its persistence.

It will be seen shortly that the vital attributes of potential weed competitors

Figure 1. The effects of fire upon the development of a community comprised of two species. See text for explanation of symbols.



are of great importance in the design of a rehabilitation strategy. Noble and Slatyer (1977) comment that VT and DT weed species may be the most difficult species to displace.

Whatever the desired attributes of the rehabilitated community may be, a subsidiary aim will be to establish a reasonably uniform vegetative cover as quickly as possible in order that the availability of resources, i.e. light, moisture and nutrients, may be effectively lowered. It is essential that resources freed by the local elimination of the vegetative phase of the target species become utilized by desirable species. Otherwise, such resources may simply be usurped by regeneration arising from the seed of either the target species or other weeds which invade subsequently or have been previously present but not abundant.

The rate at which resource availability is lowered will be of varying degrees of importance, primarily depending upon the supply of propagules of weed species. For example, where there is a small or negligible soil store of propagules and the nearest source of colonizers is some distance away, the availability of resources may remain fairly high for some time without adversely affecting the success of the rehabilitation effort. Conversely, if weed propagules are readily available (S or D recovery mechanisms), the rate at which resource availability is lowered becomes critical. It must be kept in mind that in any rehabilitation effort we are dealing in the realm of *probabilities;* any condition which serves to reduce the probability of establishment of weed species relative to that of desirable species will benefit the programme.

If seedlings of the target species are not capable of establishing in the presence of larger plants (I or P) the lowering of resource availability brought about by the growth of the replacement species will be more effective in preventing weed regeneration than if the weed species can reproduce in the presence of competition (T).

Rehabilitation Strategy

Whilst rehabilitation strategy must be largely determined by the objectives of the undertaking, it may vary considerably according to the scale of the operation. For example, over small areas it may be possible to establish cover rapidly by hand planting seedlings of selected species. This approach quickly becomes unrealistic as the size of the area to be rehabilitated increases. Over large areas, introduction of the seed of a species mixture may be the only feasible alternative.

Where weed species have not attained complete dominance and individuals of native species are relatively abundant, a practicable strategy may be to remove the weeds over a period of time, doing so sufficiently slowly that regeneration from native species can keep pace with the increased availability of resources. Bradley (1971) has provided an excellent set of guidelines for clearing weeds, by which the rate of clearing is adjusted to the relative abundance of exotic and native species. The essence of this approach is that it is ultimately beneficial to err on the side of under-clearing as opposed to over-clearing of undesirable species. Weed species, being particularly well-adapted to disturbance, are generally favoured by this phenomenon (Lewis, 1973, Harper, 1977). Indiscriminate removal of individuals may simply represent a wastage of effort.

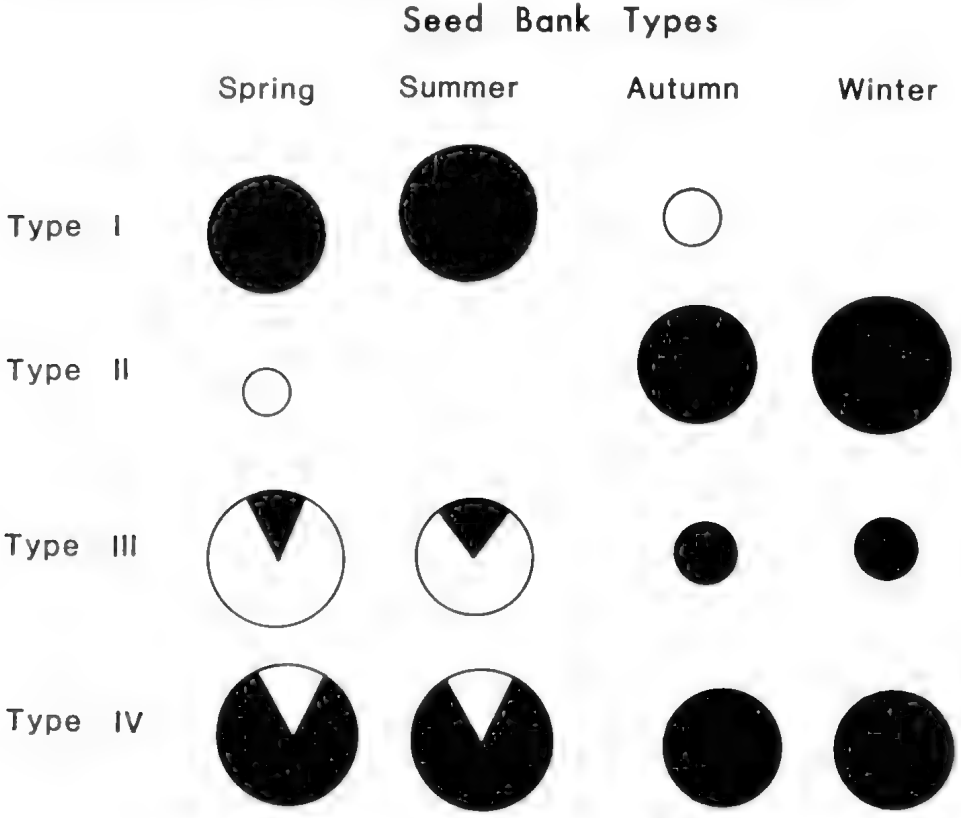
Where weed dominance occurs over large areas and the potential propagule input from native species is minimal, e.g. agricultural land which has fallen into disuse, it becomes necessary to take a more active role. In order to establish native species it will generally be necessary to remove the vegetative phase of the weed population. This removal may be effected by a variety of means, e.g. mechanical, chemical, burning. If rehabilitation is to proceed by the introduction of seed, the removal of the vegetative phase must be virtually complete; establishing seedlings of native species will generally be unable to compete with regrowth. Should herbicides be employed, they should preferably be selective and of limited persistence.

Assuming that the elimination of the vegetative phase is effective, the soil seed bank of the weed species becomes the next immediate factor with which

the rehabilitation strategy must deal. Thompson and Grime (1979), for the herbaceous flora of temperate regions, have recently grouped seed banks into four categories (Fig. 2). The first two categories both possess seed banks which are present for less than twelve months, differing only in whether maximum numbers of seed are present during summer and complete germination is brought about by environmental conditions in autumn (Type I), or the complementary pattern exists, with full germination taking place in spring (Type II). The remaining categories comprise species with persistent seed banks, differing in whether the seed bank is small (Type III) or large (Type IV) relative to the annual production of seed.

If a transient seed bank is present, it should suffice to prevent seed production prior to undertaking rehabilitation, or, this failing, to delay introducing the seed of replacement species until germination is complete and the weed seedlings are removed. An apparent difficulty with the latter approach, however, is that seasonal conditions suitable for the germination of weed seeds may coincide with the most suitable conditions for the germination and establishment of the replacement species. Where interactions between high densities of weed seedlings and the seedlings of replacement species are unavoidable, seedling growth characteristics may decide the outcome. Seedling growth may be viewed as being dependent upon both seed size and potential growth rate, and species vary markedly with respect to these attributes (Grime, 1979). A relatively large-seeded resident weed species whose seedlings

Figure 2. Idealized representation of four types of seed bank. Shaded areas: dormant seed. Unshaded areas: non-dormant seed. See text for description of types.



are characterized by high growth rates could hinder rehabilitation efforts to a larger extent than a small-seeded, slow-growing species such as groundsel bush (*Baccharis halimifolia*) (Panetta, 1977). Amor and Piggin (1977) note that the outcome of competition between exotic and native species is often difficult to predict.

Should the target species possess a persistent seed bank, the possible difficulties encountered in establishing replacement species increase in magnitude. The germination characteristics of the seed of the target species now become critical. If dormancy is largely of the induced and/or enforced type (Harper, 1977), altered light quality in conjunction with increased temperature fluctuations at the soil surface following the removal of vegetation (Thompson *et al.* 1977, Panetta, 1979) should stimulate germination, and seedlings may be removed prior to introducing seed of the replacement species. Soil disturbance should be minimized in order to ensure that seeds remaining dormant due to deep burial are not brought to the surface. If seed dormancy is predominantly of the innate type, subsequent germination becomes unpredictable and is likely to occur intermittently over a long period (Salisbury, 1964, Harper, 1977). The best strategy in this case could be to introduce the seed of replacement species at fairly high densities, in order to ensure that the 'ecological vacuum' created by clearing is filled by desirable species as quickly as possible.

Examination of the seed banks under thickets of *Rubus polyanthemos* indicates that for at least one member of the blackberry species aggregate, viable seeds are present in low numbers (F. D. Panetta, unpublished data). This would appear to indicate that seedlings arising from the soil seed banks of the species should pose little threat to rehabilitation efforts.

Selection of Replacement Species

The selection of replacement species will be dictated, with certain qualifications, by the rehabilitation aims and strategy. Given the declared aims and strategy, the "ideal" replacement species should follow. (It has been remarked with regard to my current research regarding the rehabilitation of blackberry-infested sites at Lysterfield Lake Park, Victoria, that the criteria of high growth rate, production of a uniform cover and long term stability might be most readily fulfilled by blackberry itself!)

The availability and ease of collection of seed are prime considerations in the selection of replacement species, as are their dormancy and germination characteristics. The degree of dormancy possessed by the seed should be sufficiently low that germination is rapid and uniform under field conditions. It may be possible to reduce dormancy levels by pretreatment, e.g. through stratification or scarification. If, as in many Australian communities, seed harvesting by ants is likely to reduce seed density substantially (Ashton, 1979), it may be necessary to treat seeds with feeding deterrents.

Replacement species should possess sufficient ecological amplitude to grow successfully under a wide range of resource availability. Although a high potential growth rate would be advantageous where resources are readily available, moderate to low potential growth rates are favoured under conditions of light, moisture and nutrient stress (Grime, 1979). Seedlings of replacement species arising from relatively large seeds may gain an advantage over weed seedlings arising *in situ* from smaller seeds.

A low degree of palatability should minimize growth reduction or mortality of seedlings due to grazing by rabbits and marsupials. Whilst it is possible to exclude grazing by fencing off rehabilitated areas, this represents additional expenditure and may limit the size of area which can be rehabilitated.

Conclusions

It has been established for some time that the success of a weed control effort is dependent upon subsequent modification of the environment such that once a weed individual is eliminated it cannot be replaced by an individual of either the same or another weed species. The latter

FLOW DIAGRAM FOR REHABILITATION PROCEDURE

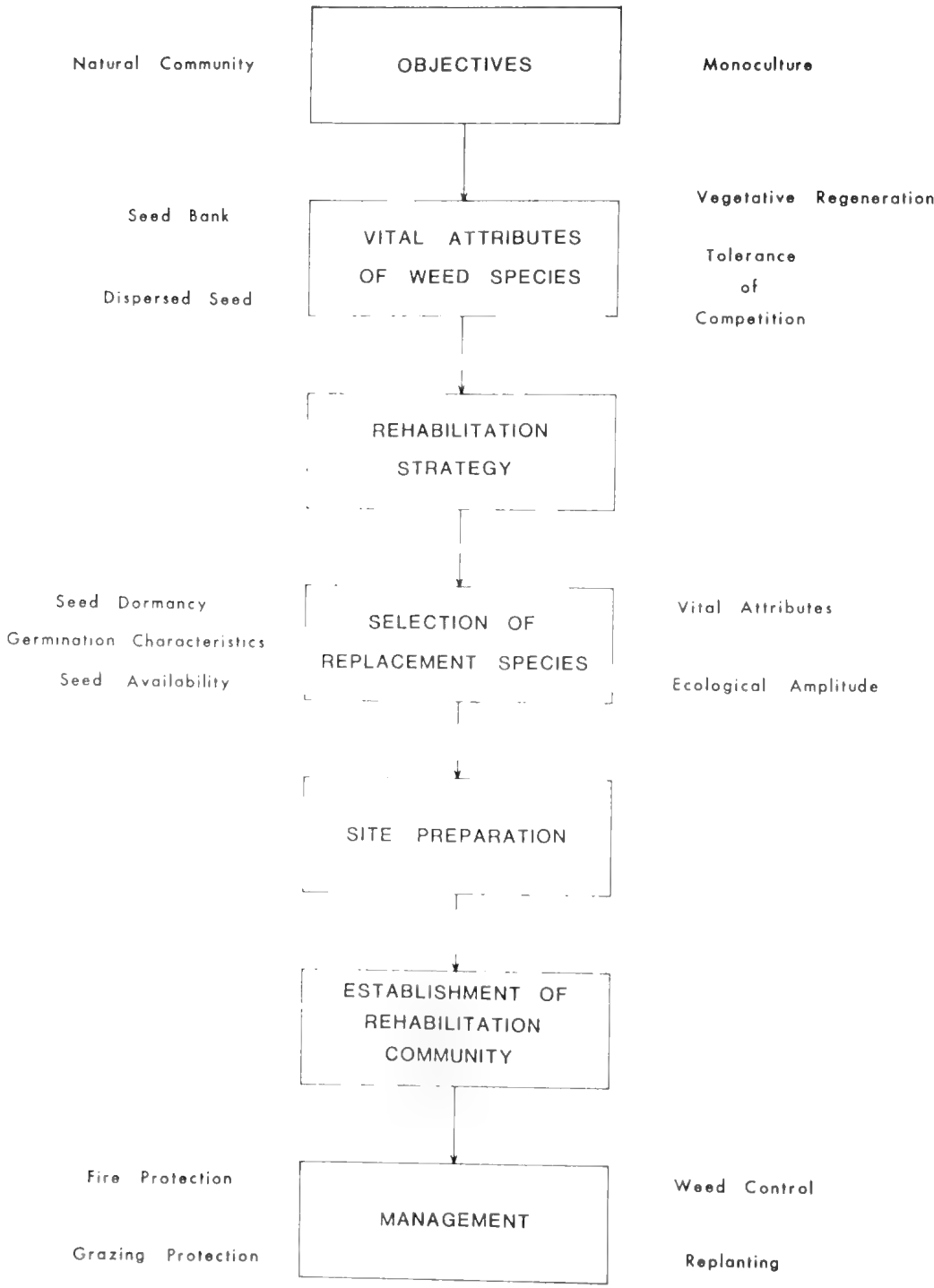


Figure 3. Rehabilitation procedure.

possibility may be of increasing importance should biological control research lead to the reduced abundance of currently troublesome species.

With a knowledge of the regeneration characteristics of particular weed species it should be possible to design a rehabilitation programme which will facilitate the establishment of a stable community comprised of desirable species (Fig. 3). If replacement species are chosen according to appropriate criteria it may be possible to minimize management, e.g. maintenance, effort following their establishment.

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Some Notes on Feral Pigs and Their Distribution in Victoria

BY SIMON E. TOWNSEND.*

The feral pig is a large, conspicuous, generally abundant animal and today an economically important component of Australia's vertebrate fauna.

The main occurrence of the feral pig is across the better watered parts of the tropical north and eastern half of the continent. Large populations are spread across Queensland, New South Wales and the Northern Territory, wherever suitable cover, feed and water are to be found. Small and local populations exist in South Australia, Tasmania and Western Australia as well as in Victoria (Alison, 1969; Frith, 1973).

As its name suggests, the feral pig is a domestic animal which has established free breeding populations. Without human management, natural selection has resulted in a phenotype with a superficial resemblance to the Eurasian wild pig *Sus scrofa*. This is the "wild boar" of the venery, or classical hunting, and the progenitor of the varieties of domestic pigs. However, this phenotype is variable owing to a continuing flow,

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by accident or design, of domestic genes into the feral population. Some authorities claim that recognizable strains of domestic breeds are often found in the wild (Frith, 1973; Rolls, 1969).

In New Guinea the remains of pigs with an age of more than six thousand years have been reported, indicating an introduction at or before that date (Chowning, 1973; Hope, 1977). Since the Australian seas probably did not reach their present level till approximately five thousand years before the present (Loffler, 1977), New Guinea and Australia may not have been separated by any significant water barrier six thousand years ago. Theoretically, it is possible that pigs might have entered Australia unaided at a date much earlier than is as yet substantiated.

Existing Australian populations are presumed to have descended from escapes or deliberate releases of European stock. It is possible that some could be of Asian origin. Their ancestors may have been brought to the north of the continent by Asian travellers or fishermen within historical times. Archaeological evidence is lacking to support this or the previous theory, therefore the feral pig cannot authoritatively be said to have a history in Australia any longer than that of European settlement.

The feral pig has received scant attention in the literature as an element of the Victorian mammal fauna. This is probably because Victorian populations are small and local, though widespread. Perhaps more importantly, bodies concerned with recording faunal distribution in the past have overlooked or ignored the species presence.

The most recent, though still incomplete, references to feral pig distribution in Victoria are to be found inthe Study Reports of the Land Conservation Council of Victoria. All Study Reports available at the time of writing were consulted and the relevent references to feral pig distribution are included in Table 2.

One earlier but important reference to the distribution of the feral pig is to be found in Allison (1969).

"There are very few pigs to be found in Victoria, most of these being spillover animals on the border of New South Wales, in the swamps and scrubs adjacent to the Murray River. One small colony exists around Benalla in the heavy forests, where they may be located the first day out — or the fifty-first."

The Australian distribution map in Frith (1973) indicates feral pig populations stretching south to the Murray River, also in an area approximately north of Melbourne and in the most eastern extremity of the state. Unfortunately he gives no references directly related to the distribution of the feral pig in Victoria.

Table 1 consists of a list of locations of feral pig populations in Victoria supplied by the Vermin and Noxious Weeds Destruction Board of the Crown Lands Department of Victoria. This can be considered the "official" distribution of Victorian feral pig populations.

Table 1 Feral Pig Population Locations in Victoria. Supplied by the Vermin and Noxious Weeds Destruction Board at 28 December 1978.

Bairnsdale	Ballarat	Benalla	Boort
Cohuna	Corryong	Gisborne	Inglewood
Kerang	Kyabram	Mansfield	Meringur
Mornington	Moyhu	Nathalia	Piangil
Red Cliffs	Robinvale	Sale	Seymour
Werrimul	Yea		

Table 2 is a series of locations of feral pig populations and their sources based on reports other than that of the Vermin and Noxious Weeds Destruction Board including first hand accounts of sightings by private individuals. The specific geographical features used to indicate the populations of Victorian feral pigs, such as towns, rivers or national parks are those closest to or encompassing them.

Abbreviations used for some sources are, Forests Commission, Victoria, F.C.V. and National Park Services, N.P.S.

Table 2 Feral Pig Population Locations in Victoria and Thier Sources Collected by S.E. Townsend.

Location	Source
Barmah	F. Borelli, 1972; F.C.V. 1979; A. Meakes, August 1977; author, March 1978.
Boole Poole Peninsula	M. Vague, April 1979.
Brisbane Ranges National Park	Anonymous, 1979.
Broadford	F.C.V., 1979.
Carrum (M.M.B.W. Sewerage Farm)	M. Carter, 1977/78.
Corryong	F.C.V., 1979.
Delatite Valley	E.V.C. Adamson, 1978.
Gippsland Lakes Coastal Park	N.P.S., 1978.
Granite Hills (near Yea)	R. Dato, 1979.
Gunbower Island	F.C.V., 1979.
Hattah Lakes National Park	N.P.S., 1978; National Parks Service, Hattah, 1977; author, December 1977.
Healesville	P.R. Brown, 1979; K. Pearce, 1979.
Holey Plains State Park	N.P.S., 1978; D. Smith, 1978.
Hoqua Valley	E.V.C. Adamson, 1978.
Inglewood	R. Fletcher, 1978; J. Malone, 1977; C. Neads, 1979; C.R. Townsend, 1978; author, December 1979.
Kinglake	R. Dato, 1979; R. Zann, 1978.
Kulkyne	National Parks Service, Hattah, 1977; Land Conservation Council, (June 1974, p. 184); author, December 1977.
Lindsay Island	J. Seebeck, 1967.
Mt. Marianne	R. Dato, 1979; C. Tomisich, 1979.
Mudgeegonga	L. Cooper, 1976.
Murmunjee	L. Cooper, 1976.
Nepean State Park	N.P.S., 1978.
Patterson River	M. Carter, 1977/78.
Pearcedale	G.M. Pizzey (no date).
Quail Island State Faunal Reserve	E. Drake-Clark, 1977; author, 1977.
Robinvale	F.C.V., 1979; author, September 1977.
Rochester	D. Clark, 1979.
Sale Common State Game Refuge	R. Johnson, 1979.
Mt. Samaria National Park	N.P.S., 1978; D. Smith, 1978.
Silver Band Falls (near Halls Gap)	R. Dunn, 1972/73.
Stockmans Reward	G. McNeil, 1979.
Mt. Tallarook	C.R. Townsend, January 1980; author, April 1980.
Tolmie	F.C.V., 1979; Land Conservation Council, (October 1974, p.73); A. Fleming, 1871; K. Holmes, 1976; R. Stoner, 1978.
Toobarac	R. Dato, 1979.
Toolangi	D. Marriot, 1979; K. Pearce, 1979.
Wannon River	W.B. Emison et al (1978, p.357); F.C.V., 1979.
Wartook Valley	W.B. Emison et al (1978, p.357).
Whitefield	F.C.V., 19799.
Wimmera River	E.V.C. Adamson, 1978.
Wombat State Forest	D. Clark, 1979; K. Pearce, 1979.

Doubtless many of the populations indicated overlap or are in reality one in the same, especially those in the headwaters of the Broken and Goulbourn Rivers. However, they represent independent sightings and illustrate how widespread is the species.

The exact origin of most Victorian feral pig populations will never be precisely known. The author would venture to suggest that at least some Murray River populations are directly descended from those that were already well established in the Riverina by the 1880s (Rolls, 1969).

While the likelihood of escape of a few domestic pigs occasionally continues, the diverse and generally unrelated locations of most Victorian populations suggests that they are the result of deliberate liberations. Such liberations, of trapped feral phenotype pigs, have been and continue to be primarily perpetrated by irresponsible hunters wanting to increase the variety of available game in the areas they hunt

over (K. Pearce, C.R. Townsend and M. Vague pers. comm.).

The feral pig is credited with killing stock, spoiling crops, damaging fencing and fouling watering points (Frith, 1973). For these reasons it was added to the list of declared vermin in Victoria in 1973.

Naturally enough the feral pig is less popular with agriculturalists than hunters. The latter find it a challenge at times. While the danger involved in hunting feral pigs is often overrated it does exist and a large pig bailed up or wounded can be a formidable opponent (Allison, 1969; Frith, 1973; Rolls, 1969).

Like any uncontrolled stock, the feral pig is a real and potential harbour of disease transferable to stock and in some cases to humans. Already a danger to agricultural production, the threat posed by the presence of the feral pig would reach disastrous proportions should foot and mouth disease enter Australia (Snowdon, no date). The feral pig population, well entrenched over much of the continent including Victoria, could become a significant vector for the spread of this contagious and virulent disease.

The continued unsettled state of much of south east Asia, with resultant large and random movements of displaced peoples has particular and pointed relevance when one considers the vast and only sporadically guarded northern coastline of Australia. If diseased stock was landed, feral pigs along the north coast could quickly become infected and transfer foot and mouth disease through the continent via the medium of the widespread feral pig population and unmanaged ungulates of all kinds. Once foot and mouth disease was endemic to this population it could become impossible to eradicate. The effect on Australia's meat industry and dairying could be disastrous, especially in respect of exports.

Similarly, non agricultural ungulates in captivity, in particular the Zoological collections in each State, would be endangered. These collections have been assiduously built up and preserved. Present quarantine requirements make further acquisitions of wild ungulates from overseas impossible.

Not the least to suffer in such an eventuality would be Victoria's four species of wild deer. Unlike most introduced wildlife, the sambar, red, fallow and hog deer are protected under the Wildlife Act 1975 and are proclaimed game.

The pressure on native wildlife by predation and competition from feral pigs is poorly understood but is presumed to be serious (Frith, 1973; Serventy, 1966). Direct predation on reptiles, amphibians and invertebrates is probably more extensive than of other animals due to their relative lack of mobility and the feral pig's omnivorous diet.

Habitat degradation is potentially a more devastating threat to native wildlife than direct predation. Areas particularly sensitive to damage by feral pigs are those which are favoured for feeding and wallowing — swamps and watercourses. These are very limited in extent in this driest of continents.

The effect of feral pigs on forest environments in Australia is largely unknown. The New Zealand experience has not shown exceptionally severe damage (Harris, 1970), at least not when compared to the devastating results of acclimatization of other species in that country. In central Victoria, the effects of rooting by feral pigs has been reported as "keeping the country open" in relation to regrowth of the understory in wet and dry eucalyptus forest (K. Pearce, pers. comm.).

The wide range of habitats inhabited by feral pigs in Victoria include coastal tea-tree and paperbark scrubs, wet and dry eucalyptus forests, mallee scrubs and the more open types of forest such as river redgum forest. As this species can be found in areas with restricted waterpoints such as mallee country, then

it seems reasonable to suspect they will travel many miles when necessary, presumably under cover of darkness, to find them.

The current, and the threatened, hazards to agriculture and the Australian environment presented by the continued existence of feral pig populations, far outweigh any possible benefits they might create. In Victoria, the most densely settled State with the most intensive agriculture, the situation is aggravated by further releases of captured feral pigs in unpopulated areas by unthinking and selfish people, to improve the opportunities for hunting. The demand for hunting as recreation is high and opportunities relatively low so these releases are understandable to a degree but cannot be condoned (Allison, 1969; Frith, 1973; Rolls, 1969). The deliberate release of feral pigs is irresponsible, antisocial and illegal.

If focus could be taken from the feral pig and redirected towards native species at present not utilized as game, the feral pig could possibly be contained and eradicated. This might be possible in Victoria where the feral pig is still only local in distribution and where a brief chance may still exist for grappling with the problem.

Frith (1973) and Wharton (no date) have discussed at length the possibility of further native species being utilized as game. Mr J. Wharton, Director of the Fisheries and Wildlife Division of the Ministry for Conservation of Victoria (pers. comm.), feels that some wallabies and native pigeons in Victoria, show potential as additional game species.

An attempt to wean attention away from feral pigs as desirable game and redirect it towards further native species might ensure that both receive needed conservation attention. It could lead to the eradication or containment of the former and the much needed and long overdue detailed study of the latter.

Acknowledgements

Help in this project was received from the Australian Deer Association, the Victorian Field and Game Association, the Vermin and Noxious Weeds Destruction Board of the Victorian Crown Lands Department, the Forests Commission, Victoria, the National Parks Service, the Bird Observers Club and the Natural Resources Conservation League of Victoria. Private persons who provided information or gave assistance at other times include E.V.C. Adamson, F. Borelli, P.R. Brown, P.G. Brown, M. Carter, D. Clark, L. Cooper, R. Dato, E. Drake-Clark, R. Dunn, A. Fleming, R. Fletcher, M. Harrison, K. Holmes, R. Johnson, J. Malone, D. Marriot, G. McNeill, A. Meakes, C. Neades, K. Pearce, G.M. Pizzey, J. Seebeck, D. Smith, "Zooey"le Soeuf, P.L. Stevens, R. Stoner, C. Tomisich, C.R. Townsend, M. Vague and R. Zann.

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Bush-peas of Victoria — Genus Pultenaea — 15

BY M.G. CORRICK†

***Pultenaea fasciculata* Benth. in *Ann. Wien. Mus. Naturg.* 2:82 (1840).**

Pultenaea fasciculata is a subalpine to alpine species of the Eastern Highlands of Victoria and is also found in New South Wales and Tasmania.

It is a small erect, somewhat procumbent shrub 15-30 cm high, but sometimes trailing if growing in thick vegetation. The stems are terete with a silvery pubescence on young growth.

The alternate, terete leaves are 3-10 mm long, grooved on the upper surface and with a slender, fragile, mucronate tip. The upper leaf surface is not visible, but the lower surface is slightly scabrid with silvery appressed hairs mainly on the young growth.

The slender, dark brown stipules are 1-2 mm long with recurved tips.

The orange flowers are solitary in the leaf axils towards the ends of the branches, but the tips grow on before the flowers die. The standard is 8-9 mm long and 8-9 mm wide and is tinged with purple brown, as also are the keel petals.

The calyx is silky pubescent, 4-5 mm long with a pedicel 1-2 mm long. The upper calyx lobes are broader and less deeply divided than the lower. The dark brown bracteoles have ciliate margins and a few pale scattered hairs on the back. They are attached at the base of the calyx tube but vary considerably in shape and length, from 1.5 mm long and 1 mm wide on Lake Mt. collections to 3-4 mm long and 1 mm wide on specimens from Mt. Cobberas and vicinity.

Each flower is subtended by a single reduced leaf with enlarged stipule.

The ovary and base of the style are pubescent with white silky hairs and the plump pod is also silky pubescent and does not extend beyond the tips of the calyx lobes.

SPECIMENS EXAMINED included: Bogong High Plains, 28.i. 1966, *A.C. Beauglehole 15747* (MEL 1517572); Native Cat Plain, 29. i. 1971, *A.C. Beauglehole 36616* (MEL 1517575); Nunniong Plateau, 5.i. 1949 *N.A. Wakefield* (MEL 1507294); Lake Mt., 25.i.1948, *J.H. Willis* (MEL 1517580).

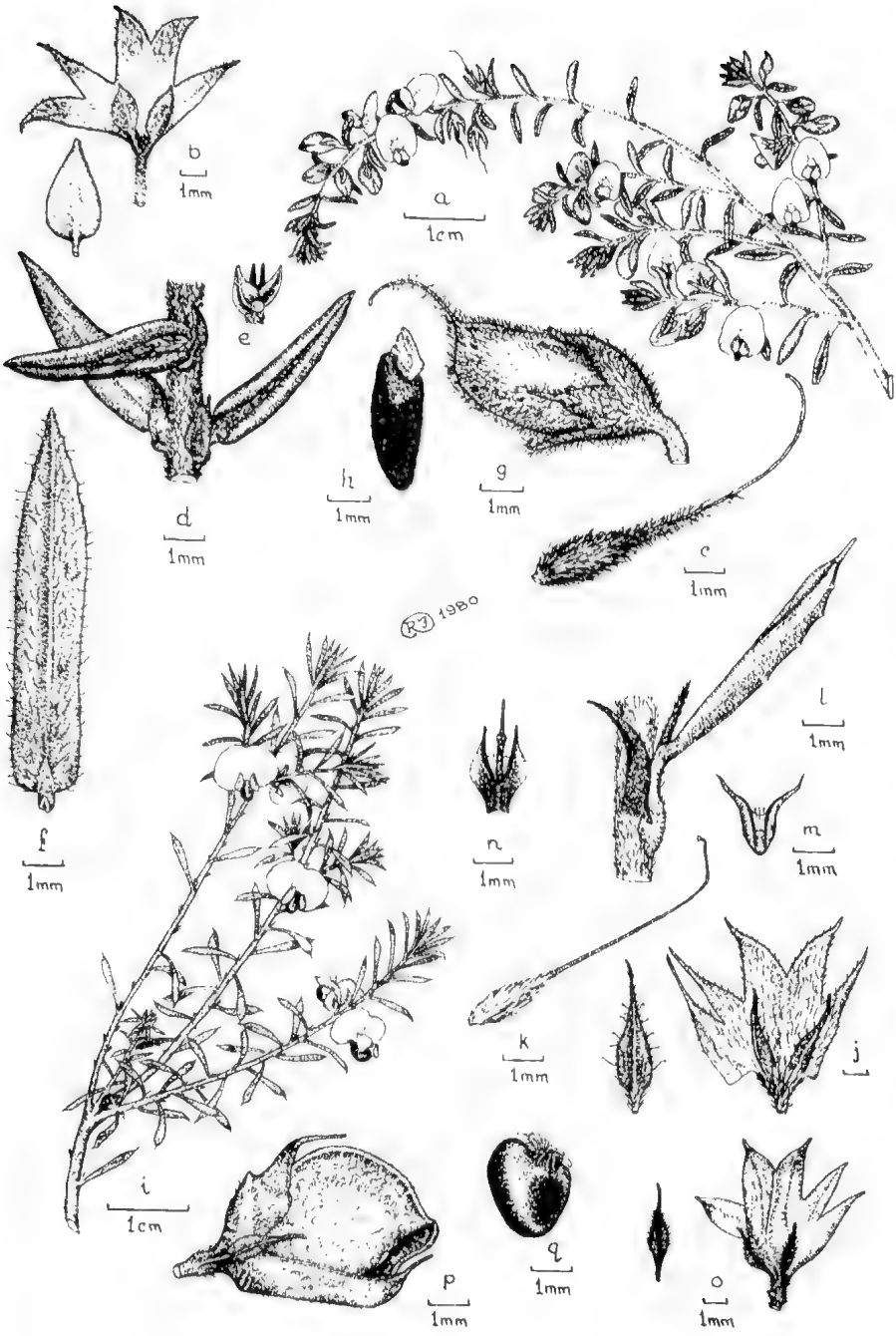
***Pultenaea graveolens* R. Tate in *Trans. Roy.Soc.S.Aust.* 7:68 (1885)**

This species is scattered in isolated auriferous areas of Western Victoria and is in a few localities in South Australia, but is apparently nowhere common.

Pultenaea graveolens is a resinous, highly aromatic and often hairy shrub 1-1.5 m high with rather drooping branches. The rounded stems are hirsute and light brown when young.

† 7 Glenluss Street, Balwyn, Victoria.

Fig. 20. a — h, *Pultenaea graveolens*. a, habit; b, calyx and bracteoles, one bracteole drawn a little larger, from MEL 1517538; c, style and ovary from MEL 1517589; d, leaves and stipules; e, stipule from MEL 1517583; f, larger, more hairy leaf form from the Grampians, MEL 1517589; g, pod; h, seed, from MEL 1517575.
i — q, *Pultenaea fasciculata*. i, habit; j, calyx and bracteoles, one bracteole drawn a little larger, k, style and ovary; l, leaf and stipule; m, stipule; n, enlarged stipule with reduced leaf, all from MEL 1517572; o, calyx and bracteoles of specimen from Lake Mountain showing very short bracteoles, MEL 1517580; p, pod; q, seed from MEL 1517581.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The alternate leaves are ovate-linear 2-15 mm long and 0.5-3 mm wide, with an acute tip and tightly inrolled margins. The lower leaf surface is usually scabrid and hirsute, the upper surface is paler with short curled hairs.

The brown, viscid stipules are 1 mm long and stand well out from the stem.

The pale orange flowers are solitary in the leaf axils of short lateral branches. The standard is 7-9 mm wide and 7-9 mm high with purple-brown markings; the wings and keel petals are also tinged with purple-brown.

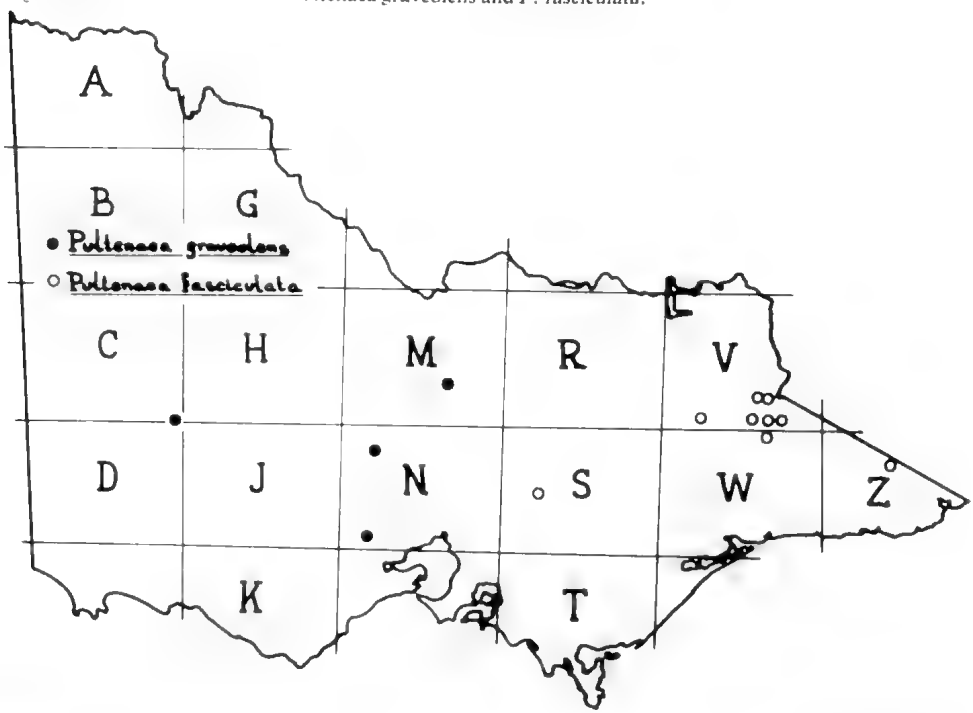
The viscid, usually slightly hairy calyx is 5-6 mm long with a pedicel of 3-4 mm. The two upper calyx lobes are broader and less deeply divided than the slender acuminate lower lobes. The bracteoles are 1-3 mm long and 1.5-2 mm broad; they are attached at the base of the calyx tube and extend to the base of the lobes.

The ovary is densely villous with white silky hairs which extend along almost the whole length of the style. The pod is plump and villous and well exserted from the calyx. Flowering time is late October.

There is considerable variation in plants from the different populations of this species in Victoria. Grampians specimens have the largest leaves and very bright coloured, large flowers and all parts of the plant are hairy. Specimens from Castlemaine area are almost glabrous and have the smallest leaves, while the Stieglitz population is intermediate between the two. The viscid, distinctive, strongly aromatic exudation is common to all populations; it is most noticeable at the time the first flowers open and has been variously described as like "Spirit contaminated with animal matter", curry or cream cheese.

SPECIMENS EXAMINED included: Trooper's Creek, 30.i.1969, *M.G. Corrick 1941* (MEL 1517589) Rushworth Forest, 6.iv.1980, *M.G. Corrick 6538* (MEL 1517069) Baillieston, x.1929, *C.J. Mason* (MEL 1517583); Porcupine Ridge, x.1963, *B. Strange,* (MEL 151587); Stieglitz, 30. x. 1943, *J.H. Willis* (MEL 1517584).

Fig. 20b. Known distribution of *Pultenaea graveolens* and *P. fasciculata*.



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Field Naturalists Club of Victoria

Reports of recent Club activities

General Excursion to Anglesea
Sunday 7 December

Leaders Mary D.White and Joan Forster had thoroughly covered the area previously and led us to exciting things. There were more than a dozen different orchids including both the Large and the Small Duck-orchid — *Caleana major* and *C.minor*. And there was a broad patch of Red-beaks *Lyperanthus nigricans*, unfortunately now all with dead heads, but Mary White had discovered the red patch in October and we imagined them as they were then.

Among many other botanical interests were the two fringe-lilies — Common Fringe-lily *Thysanotus tuberosus* and Branching Fringe-lily *T.dichotomus*. Anglesea is one of the few places where the latter can be found.

We were surrounded by bird song and those observed included the Dusky Woodswallow, Blue-wing Parrot and Striated Pardalotes. The pardalotes were the highlight of the day. They had burrows in a low bank and several of them were darting in and out — quite regardless of the crowd of field naturalists only a few yards away. Everbody had an excellent view.

We had hoped to see Rainbow-birds which had been observed last week but they did not reveal themselves today.

Thanks go to our leaders for a superbly organised and enriching trip.

General Meeting
Monday 8 December

President Dr Brian Smith opened with two important announcements.

Conservation Award to FNCV. Each year the CCV (Conservation Council of Victoria) honours an organisation that has made a significant contribution to conservation. The 1980 Award went to this Club and was presented to our President by the Premier at government offices earlier this evening. The visible prize is a large oil painting by the environment artist Neil Douglas.

New FNCV Treasurer. Mr David Dunn has accepted the position of treasurer to this Club and we wish him well in his arduous undertaking. He follows Mr Dan McInnes who has been treasurer for about twelve years. Actually, the Club has been without a treasurer since the last Annual Meeting but Mr McInnes (being Mr McInnes) has continued to see us through although officially he was merely a "bookeeper". He has done a terrific job for FNCV, nurturing our finances and always planning what is best for the Club. All members will join in thanking Dan McInnes for his great contribution over a very lengthy period.

Hawthorn Juniors. The President said that it seems appropriate that the last meeting in our Centenary year should be provided by those who will see the Club through some of its second centenary. He then introduced the

President of Hawthorn Junior FNC, Mr Malcolm Turner.

Mr Turner spoke briefly of the Hawthorn Club and emphasised that, for some years now, the Club has been run entirely by the juniors themselves — those under 25 years. He introduced each speaker in turn.

On the Seashore. Barbara Thompson, aged about 10, spoke of things found on the shore — sponges, crabs, sea stars, shells. Barbara gave some information about each and showed specimens.

Blue-tongue Lizards. Brian Glassenbury, about 13, talked of five young blue-tongues he owned, how quickly they grew, what he fed them on, the different disposition of individuals.

Flies are insects with only two wings not four, as explained by Nick Bastow, age about 15. He said there are 6300 Australian species in a world total of 8000, that the house-fly makes 200 wing beats per second, the mosquito 600, and the blowfly travels 260 body-lengths in a second. Nick concluded with comments on the effect of DDT on mosquitoes in India.

Cape Barren Geese. Damien Cummins, about 15, stated that only about 5000 of these geese still survive on Bass Strait islands; they breed from June to September with average of 4.7 eggs per clutch, and grow to 22" tall. he maintained that conservation regulations are not strict enough but reported the recent establishment of the Patriarch sanctuary on Flinders Island where crops are planted so the geese won't move on to the farms.

Glennies Islands. Malcolm Turner showed slides of the Glennies — four islands off the west coast of Wilsons Promontory. They are the same granite formation as the Prom, large areas are bare rock and there is no surface water. Bush Rats (darker, more docile and more plentiful than on mainland) and Swamp Antechinus were trapped. There was evidence of White Skinks and Water Skinks, many burrows of Fairy Penguins and Muttonbirds (Short-tailed Sheerwater), bones of the Fur Seal, and Dolphins off shore. Archeologists are studying the middens.

The President thanked Hawthorn Club for the varied and interesting programme.

Exhibits centred on activities of Hawthorn Juniors. The previous day they had been on a water plant excursion led by Helen Aston and there was a large display of such plants. Publications produced by Hawthorn Juniors were for sale.

More trees on farms. A letter was read to the meeting asking this Club to support the writer's plea for tax rebates to farmers who plant more trees. He had written to the Prime Minister and the Treasurer about the matter and asked FNCV members to do the same.

South Gippsland. Members listened to the FNCV submission to the LCC (Land Conservation Council) concerning extensions to national parks in Gippsland. The meeting endorsed the submission.

General Meeting
Monday 12 January

Land Planarians. After an absence of six years, Mr Leigh Winsor was the first speaker in this Members Night. He lives at Townsville where he is working on land planarians. He had expected flatworms in the tropics to be more pentiful, larger and more colourful than in the south, but his expectations were wholly faulty. However, other wildlife around (almost within) Townsville is abundant and he had listed 80 bird species in his garden.

Referring to a visit to Britain, Mr Winsor said how astonished he was that all cryptosoic life forms are known; here in Australia there is yet much to be discovered and studied.

Eucalypts. Mr Alan Morrison showed slides of eucalypt trees — flowers, fruits and trunks of several species.

Repitle, bird and mammal slides were shown by Mr Lloyd Thomas.

Insects were included in the slides shown by Miss Wendy Clark.

Marine egg capsules. Dr Brian Smith showed slides of egg capsules of molluscs (shells, squid, etc) in astonishing variety of size and shape.

Pond Life. Mr McInnes spoke of Albert Park Lake where water weed, which previously hampered boats, has been completely removed yet there is still as many microscopic creatures as before. Under microscopics he exhibited specimens taken there of water mites, water boatmen, back swimmers, copepods and the only plant life — 1/8" spots of algae growing on a sheet of plastic.

Exhibits, as well as the pond life, included a scorpion from Toolangi Forest, nest of a silver-eye, rat-tail maggots from a water bin, and an album of photos of the Nature Show.

GROUP MEETINGS

All FNVC members are invited to attend any Group meeting; no extra charge.

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

First Tuesday — Mamal Survey Group.

Tuesday, 3 February. Members night.

Tuesday, 3 March. Outback Australia.

Third Wednesday — Microscopy Group.

Half hour members exhibits and observations. Wednesday, 11 February. Gadget Night. Leader: Mr D. Wentworth. Note change from third Wednesday for this month only.

Wednesday, 18 March. Green Algae. Speaker; Mr D. McInnes.

First Wednesday — Geology Group.

Wednesday, 4 February. Members night.

Wednesday, 4 March. Earthquakes and their prediction. Speaker: Dr M. Etheridge, Monash University.

Second Thursday — Botany Group.

Thursday, 12 February. North America; the beauty of wild flowers. Speakers: Mr Thiess and Ms Doery.

Thursday, 12 March. From here and there; travels round Australia. Speakers: Mr and Mrs O. Brewster.

At the Conference Room, the Museum, Melbourne, at 8.00 p.m. Good parking — enter from Latrobe St.

First Monday — Marine Biology and Entomology Group.

Monday, 2 February. Holiday observations and members exhibits, slides.

Monday, 2 March. Molluscs of Port Phillip Bay. Speaker: Dr Brian Smith.

Monday, 6 April. Pond life with a movie camera. Speaker: P. Genery.

GROUP EXCURSIONS

Botany Group — last Saturday.

Saturday, 28 February. Mt Donna Buang.

Saturday, 28 March. Pt Wilson, Port Phillip Bay.

Geology Group — second Sunday.

Sunday, 8 March. Mt Robinson and Kinglake.

Mammal Survey Group.

Saturday, 14 — Sunday, 15 February. Camp at Mt Worth.

Saturday, 7 — Monday, 9 March. Camp at Mt Bullfight.

Day Group — third Thursday.

Thursday, 19 March. Train outing to Fern Tree Gully National Park. Train to Upper Fern Tree Gully from Flinders St. at 10.15 a.m. Leader: I. Gillespie 578 1879.

There will be no April outing.

Field Naturalists Club of Victoria

Established 1880

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 Honorable SIR HENRY WINNEKE, KCMG, KCVO, OBE, KStJ, QC.

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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 DAIRY OF COMING EVENTS

GENERAL MEETINGS

At the National Herbarium, the Domain, South Yarra.

Monday, 13 April, 8.00 p.m.

Otway study night. Keynote speakers will be arranged and all Groups are asked to prepare a short address.

Monday, 11 May.

Annual General Meeting. Presidential address by Dr Brian Smith — zoological research at the Museum.

Monday, 15 June.

Film night — South-west Tasmania.

New Members — March/April General Meetings.

Ordinary

Ray Carter, Clematis Rd, Clematis.
Mavis Condon, 6 Evandale Rd, Malvern.
Beverley Cross, 14 Simpson's Rd, The Basin.
L. Gerke, 12/546 Toorak Rd, Toorak.
Andrew Isles, 103 Noone St, Clifton Hill.
Fiona Johnson, 51 Mason St, Hawthorn.
Joan Locke, 139 Mary St, Richmond.
Ulla Pedersen, 1/8 Duff St, Sandringham.
Julie Raines, 13 Fortune Ave, Lilydale.
Libby Sandiford, 241 Royal Pde, Parkville.
Bruce Straw, 26 Panorama Ave, Lower Plenty.
Mary Todd, 1 Glenroy Rd, Hawthorn.

Country

Grant Baverstock, 13 Helena St, Highton.
Fred de Munk, Wesley Camp, Old Chum Creek Rd, Healesville.
Peter Dostine, 371 Princes Highway, Sylvania Heights, New South Wales.
A. Piesse, 17 Warwillah Ave, Wangaratta.
B. Wiecek, 2 Milburn St, St. Mary's.

Joint

Adrian and Philip Daniell, 24 Ruskin Ave, Croydon.
Christine Drum and Lindsay Delzoppo, C/O 5 Emo Rd, East Malvern.
Keith and Dorothy Every, 16 Valley Rd, Mt. Waverley.
Martin and Wendy Mebalds, 5 Mitchell St, St. Kilda.
G.W. and L.L. Quick, 17 Penguin St, Melton.
B. and H. Sterkenberg, 21 Watsons Rd, Moe.

FNCV EXCURSIONS

Sunday, 3 May. Pirianda Gardens. These Gardens are managed by the National Parks Service and only open at certain times of the year. Visits must be booked in advance and numbers are limited. The coach will leave Batman Ave at 9.30 a.m. Fare $6.00. Bring a picnic lunch.

Sunday, 7 June. Zoological Gardens. Meet at the main extrance at 11.00 a.m. Bring a picnic lunch.

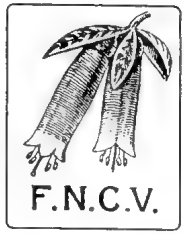
Preliminary notices:

Saturday, 17 October — Friday, 6 November. New Zealand, North Island. A number of members have indicated in this excursion so arrangements will be proceeded with; however more bookings are required and all bookings should be confirmed with a $50.00 deposit. This excursion covers an area not usually included in tours. Cape Kidnappers is the only mainland gannet rookery in the world according to the brochures. The tentative programme is: Oct. 17 Auckland; Oct. 18 Auckland/Coromandel/Whitianga; Oct. 19 Whitianga/Tauranga; Oct. 20 Tauranga/Rotorua; Oct. 21 Rotorua/Whakatane; Oct. 22 Whakatane/Hicks Bay; Oct. 23 Hicks Bay/Gisborne; Oct. 24 Gisborne/Wairoa; Oct. 25 Wairoa/Napier, visiting Urewera National Park; Oct. 26 Cape Kidnappers/Napier; Oct. 27 Napier/New Plymouth; Oct. 28 New Plymouth; Oct. 29 New Plymouth/Tongariro National Park; Oct. 30 National Park; Oct. 31 National Park/Auckland; Nov. 1 Auckland/Kaitaia; Nov. 2 Reinga/Kaitaia; Nov. 3 Kaitaia/Bay of Islands; Nov. 4 Bay of Islands; Nov. 5 Bay of Islands/Auckland; Nov. 6 Auckland/Melbourne. The cost is expected to be approximately $1250.

Special study strips:

Contact Wendy Clark for details (A.H. 859 8091).

Saturday, 16 — Sunday 17 May. Snails of Otways Forest. Leader: Dr Brian Smith.



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Cover illustration: Stranded Blue whale *Baelonoptera musculus* near Warrnambool
Photo P. Martin

A Blue Whale *Baelonoptera musculus* stranded near Warrnambool, Victoria.

By A.C. Isles*

On 6 April 1976 an immature male Blue Whale *Baelonoptera musculus* was stranded at Levys Point (142°26'E 38°23'S), 4 km west of Warrnambool. It was first sighted, still alive, at about 1600 hours by Mr E. Barker of Warrnambool (Warrnambool Standard, 7 April 1976). Diagnostic features were the all black baleen, blue body colour with paler mottled patches on the dorsal surface, white underside to the flippers (see Morzer Bruyns 1971; Wakefield 1967) and distinctive, broad, "boat-shaped" skull (R.M. Warneke *pers. comm.*).

At about 0930 hours next day the animal was apparently dead and by the afternoon its body colour had changed to dark grey. There were no noticeable lesions, barnacles or ectoparasites on the skin.

The following measurements (see Baker 1972) were taken using a 100 foot cloth tape measure.

Total length (tip of jaw to notch of tail flukes)	19.1m
Tip of upper jaw to centre of eye	3.9m
Tip of upper jaw to anterior insertion of flipper	3.7m
Tip of upper jaw to tip of dorsal fin	14.6m
Girth	c4.5m

(measurement taken directly behind flipper; 7.5m from upper jaw to point of girth measurement).

Maximum flipper width	0.71m
Tip of one tail fluke to centre of tail notch	2.18m

It was not possible to measure tail flukes from tip to tip; a reasonable estimate of this measure would therefore be 4.4m.

Depth of notch between flukes	0.23m
Height of dorsal fin (tip to base)	0.18m

On the 10 April staff from Monash University Zoology Department and the National Museum of Victoria attempted to remove the skull, but could only remove the lower jaw (now in the NMV No. C23571) and one flipper (in the possession of the Zoology Department, Monash University; No. 5579). By the 17 April very little of the whale was left on the beach except for some baleen, pieces of flesh, and skull fragments. Most of the carcass had been taken out to sea by a high tide and the remaining debris was probably a product of the field dissection. On the 20 June a few remains, including the tail flukes and part of the vertebral column, were found some 6 km from the original stranding point, 500 m east of the Cutting (142°23'E, 38°21'S) high up on the beach and buried in sand.

Wakefield (1967) gives details of three other Blue Whales stranded in Victoria: at Jan Juk, outside Port Phillip Heads

Fig. 1. Blue whale stranded at Levys Pt.

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in the winter of 1865 or 1866; at Anglesea April 1955; and at the mouth of the Fitzroy River, Portland, 1957.

Colour transparencies and 16mm film taken when the animal was still alive are in the possession of Fisheries and Wildlife Division, Victoria.

Acknowledgements

Joan Dixon, Curator of Vertebrates, NMV for providing literature when urgently needed and commenting on the paper; R.M. Warneke and P.W. Menkhorst for commenting on the paper and offering valuable suggestions.

Also to W. Smith and R. Thompson for assistance in the measuring of the whale.

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Baker, A.N. 1972. New Zealand Whales and Dolphins. Biological Society, Victoria University of Wellington, N.Z. as *Tuatara* 20: 1-44.

Morzer-Bruyns, Capt. W.F.J. 1971. Field Guide of Whales and Dolphins Zieseniskacle 14", Amsterdam.

Wakefield, N.A. 1967. Whales and Dolphins Recorded for Victoria. *Victorian Nat 84:* 273-281.

Fig. 2. View of the whale.

Fig. 3. Viscera of the whale.

Alterations and Additions to the Vascular Flora of Victoria

BY A. C. BEAUGLEHOLE*

Introduction

In earlier issues of the Victorian Naturalist†, I dealt with about 300 alterations in nomenclature and 330 additional species to the vascular flora of Victoria.

This paper deals with a further 100 alterations and 60 additional species. This has been largely due to the splendid continued co-operation of my many helpers who have kept me posted with current revisions from scientific papers both within and outside Australia, plus my own observations and records.

Recording on the Grid system of Churchill and de Corona (1972) has been maintained by a number of workers, with the result about 1150 additions have been made since 1977 thus making a grand total of about 7300 additions since 1972. However, on the debit side, I, along with help from others have recognized about 518 grids†† which have been considered erroneous or very doubtful. These should be taken into account when species totals are being made for individual grids at some future date.

† see Victorian Nat. 95: 67-74 and 198-203 (1978)
†† see Victorian Nat. 97: Previous articles (1980)

* 3 Beverley Street, Portland, Victoria. 3305.

Acknowledgements

I again wish to thank the Directors

and staff at Australian and overseas herbaria for continued assistance, in particular the National Herbarium of Victoria for checking and housing voucher specimens of new records.

My thanks again to Dr. R. F. Parsons for unstinted assistance in various ways.

To the many others, too numerous to mention individually, who have supplied many new distribution records and vouchers, a special thank you. I trust that you will continue this splendid work.

Alterations to the vascular flora of Victoria

The following list is based on the alphabetical arrangement of Churchill & de Corona (1972).

Symbols:

C Change of name for various reasons. The second name in each case to be used for Victorian records. Note that in some cases the replaced name is still valid but the species does not occur in Victoria. Superseded names are printed in italics.

S Synonym. The first name is now regarded as a Synonym of the second name.

\+ Additional species now recognized and segregated.

— Deletion e.g. species now thought to be hybrids, or no longer recognized as distinct at species level; no records of spontaneous occurrence in Victoria etc.

S *Acacia ligulata* A. Cunn. ex Benth.: **A. bivenosa** DC. ssp. **wayi** (Maiden) Pedley; see Pedley *Austrobaileya* 1 (1): 26-29 (1977).

C **Agropyron junceum* (L.) Pal.: ***A. junceiforme*** (A. & D. Love) A. & D. Love; see Hubbard, *Grasses:* 105 (1952).

S **Agrostis semiverticillata* (Forsk.) C.Chr.: ***A. viridis*** Gouan; see Simon, *Bot. Branch Tech. Bull.* 3: 4 (1978) after examination of Kerguelen in *Lejeunia* 75:247 (1975).

S **Agrostis tenuis* Sibth.: ***A. capillaris*** L.; see *2*: 172.

\+ ***Amaranthus hybridus*** L.: plus ***A. powellii*** S. Watson; A. Kanis pers. comm. (All records will need to be checked).

S **Antirrhinum orontium* L.: ***Misopates orontium*** (L.) Rafin.; see *9*: 224.

S *Aphanes pentamera* Rothm.: **A. australiana** (Rothm.) Rothm.; see *5*: 194.

\+ **Apium prostratum** Labill ex Vent: plus **A. annuum** P. S. Short; see Short *J. Adelaide Botanic Gardens* 1(4): 230-234 (1979).

S *Arthrocnemum arbuscula* (R.Br.) Moq.: **Sclerostegia arbuscula** (R.Br.) P. G. Wilson; see Wilson *Nuytsia 3*: 20 (1980).

S *Arthrocnemum halocnemoides* Nees var. *pergranulatum* J. M. Black: **Halosarcia pergranulata** (J. M. Black) P. G. Wilson; see Wilson ibid. 40.

S *Arthrocnemum halocnemoides* Nees var. *pterygospermum* J. M. Black: **Halosarcia pterygosperma** (J. M. Black) P. G. Wilson; see Wilson ibid. 48.

S *Arthrocnemum leiostachyum* (Benth.) Paulsen: **Halosarcia indica** (Willd.) P. G. Wilson subsp. **leiostachya** (Benth.) P. G. Wilson; see Wilson ibid. 66.

S *Arthrocnemum lylei* (Ewart & J. White) J. M. Black: **Halosarcia lylei** (Ewart & White) P. G. Wilson; see Wilson ibid. 49.

S *Arthrocnemum pruinosum* Paulsen: **Halosarcia pruinosa** (Paulsen) P. G. Wilson; see Wilson ibid. 54.

— *Atriplex muelleri* Benth.; Best omitted from Victorian flora; see *12*:94.

C *Atriplex prostrata* R.Br.; P. G. Wilson pers. comm. informs that A. prostrata R.Br. (1810)—a later homonym of A. prostrata D.C. (1805) be replaced by **A. pumilio** R.Br.

S *Bassia biflora* (R.Br.) F. Muell.: **Dissocarpus biflorus** (R.Br.) F. Muell.; see Scott *Dept. of Plant Biology, Univ. of Birmingham.* Birmingham, Great Britain: 101-119 (1978).

S *Bassia birchii* (F. Muell.) F. Muell.: **Sclerolaena birchii** (F. Muell.) Domin; see Scott *ibid.*

S *Bassia brachyptera* (F. Muell.) R. H. Anderson: **Sclerolaena sp.**; (no combination available) NSW per. comm.; In the author's Victorian Vascular Plant Checklists (in the press) this plant is referred to as **Sclerolaena sp. (A).**

S *Bassia caputcasuarii* J. H. Willis: **Sclerolaena caputcasuarii** (Willis) A. J. Scott: see Scott *Dept. of Plant Biology, Univ. of Birmingham,* Birmingham, Great Britain: 101-119 (1978).

S *Bassia convexula* R. H. Anderson: **Sclerolaena convexula** (R. H. Anderson) A. J. Scott: see Scott *ibid.*

S *Bassia diacantha* (Nees) F. Muell.: **Sclerolaena diacantha** (Nees) Benth.; see Scott *ibid.*

S *Bassia divaricata* (R. Br.) F. Muell.: **Sclerolaena divaricata** (R.Br.) Domin; see Scott *ibid.*

S *Bassia obliquicuspis* R. H. Anderson: **Sclerolaena obliquicuspis** (R. H. Anderson) Ulbrich; see Scott *ibid.*

S *Bassia paradoxa* (R.Br.) F. Muell.: **Dissocarpus paradoxa** (R.Br.) F. Muell.; see Scott *ibid.*

S *Bassia parviflora* R. H. Anderson: **Sclerolaena parviflora** (R. H. Anderson) A. J. Scott; see Scott *ibid.*

S *Bassia patenticuspis* R. H. Anderson: **Sclerolaena patenticuspis** (R. H. Anderson) Ulbrich; see Scott *ibid.*

S *Bassia quinquecuspis* (F. Muell.) F. Muell.:

Sclerolaena muricata (Moq.) Domin; see Scott *ibid.*

S *Bassia ramsayae* J. H. Willis: **Sclerolaena ramsayae** (Willis) A. J. Scott; see Scott *ibid.*

S *Bassia sclerolaenoides* (F. Muell.) F. Muell.: **Eriochiton sclerolaenoides** (R. H. Anderson) A. J. Scott; see Scott *ibid.*

S *Bassia stelligera* (F. Muell.) F. Muell.: **Sclerolaena sp.**; (no combination available). NSW pers. comm.; In the author's Victorian Vascular Plant Checklists (in the press) this species is referred to as **Sclerolaena sp. (B).**

S *Bassia tricuspis* (F. Muell.) R. H. Anderson: **Sclerolaena tricuspis** (F. Muell.) Ulbrich; see Scott *Dept. of Plant Biology, Univ. of Birmingham*, Birmingham, Great Britain: 101-119 (1978).

S *Bassia uniflora* (R.Br.) F. Muell.: **Sclerolaena uniflora** R.Br.; see Scott *ibid.*

\+ **Bursaria spinosa** Cav.: plus **B. lasiophylla** E. M. Bennett; see Bennett, *Nuytsia* 2 (4): 192 (1978).

S *Caladenia reticulata* R. D. Fitz G.: **C. heugelii** Reichb. f.; see *2:* 396-397.

S *Callitris verrucosa* (A. Cunn. ex Endl.) F. Muell.: **C. preissii** Miq. ssp. **verrucosa**; see Garden, *Contr. N.S.W. Herb.* 2:375 (1956).

S *Cardamine stylosa* DC.: **Rorippa gigantea** (Hook.f.) Garnock-Jones, *N.Z.J. Bot.* 16: 119 (1978).

C Casuarina glauca Sieber ex Spreng.: **C.obesa** Miq.; L. A. S. Johnson pers. comm.

S **Celsia cretica* L.: ***Verbascum creticum** (L.) Cav.; see *9:* 309.

S **Chrysanthemum lacustre* Brot.: ***Leucanthemum vulgare** Lam.; see *10:* 176.

S **Chrysanthemum leucanthemum* L.: ***Leucanthemum vulgare** Lam.; see *10:* 176.

S **Chrysanthemum parthenium* (L.) Bernh.: ***Tanacetum parthenium** (L.) Schultz Bip.; see *10:* 171.

S **Chrysanthemum vulgare* L. ***Tanacetum vulgare** (L.) Bernh.; see *10:* 170.

S **Cirsium syriacum* (L.) J. Gaertn.: ***Notobasis syriaca** (L.) Cass,; see *10:* 474.

S **Crepis taraxicifolia* Thuill.: ***C. vesicaria** L.; see Sell, *Bot. J. Linn. Soc.* 71:254 (1976).

S *Cyclosorus penniger* (Forst.f.) Copeland: **Pneumatopteris pennigera** (Forst.f.) Holttum; see Holttum, *Blumea* 21: 305 (1973).

— Cyperus brevifolius (Rottb.) Hassk.: all Victorian records belong to **C. sphaeroideus** L. A. S. Johnson & O. D. Evans; NSW pers. comm.

S *Cyperus rutilans* (C. B. Clarke) Maiden & Betche: **C. Ihotskyanus** Boeck.; see Wilson, *Telopea* 1 (6): 464 (1980).

\+ **Daviesia ulicifolia** Andr.: plus **D. arenaria** M. D. Crisp; see Crisp, *J. Adelaide Bot. Gard.* 2 (2): 163-166 (1980).

S,. *Daviesia virgata* A. Cunn. ex Hook.: **D. mimosoides** R.Br.; M. D. Crisp pers. comm.

S *Diplachne fusca* (L.) Beauv. ex Stapf.: **D. reptatrix** (L.) Druce; see Kerguelen, *Bull. Bot. Fr.* 124: 337-349 (1977).

— Epacris serpyllifolia R.Br.; apparently this species does not occur in Victoria — author's observation.

— Epilobium tasmanicum Hausskn; apparently does not occur in Victoria; see Raven & Raven, *N.Z. Dept. of Scientific & Industrial Res. Bull.* 216: 179-181 (1976).

— Eucalyptus stricta Sieber ex Spreng: apparently the Mt. Wellington record is erroneous; NSW pers. comm.

— **Fumaria officinalis* L.; apparently does not occur in Victoria; see *12:* 163.

S **Gnaphalium purpureum* L.: ***Gamochaeta purpurea** (L.) Cabrera; see Cabrera, *Bol. Soc. Argent. Bot.* 9: 377 (1961).

S **Homeria breyniana* (L.) G. J. Lewis: ***H. flaccida** Sweet; see Goldblatt, *J. S. African Bot.* 39: 133-140 (1973).

S **Hordeum leporinum* Link: The recent grass volume of Flora Europea treats this and **H. glaucum* Steud. as subspecies of ***H. murinum**; B. K. Simon pers. comm.

S **Hypericum elatum Ait.*: ***H. inodorum** Miller; see Miller, Gard. Dict: ed. 8, No. 6 (1968).

S **Inula graveolens L.*: ***Dittrichia graveolens** (L.) W. Greuter; see Greuter, Exsicc. Genav. 4: 71 (1973).

C+ Isoetes humilior F. Muell. ex A. Br.: **I. muelleri** A.Br.: see Marsden, *J. Adelaide Bot. Gard.* 1(1) 37-54 (1976): plus another species under investigation; C.R. Marsden pers. comm.

S **Koeleria phleoides* (Vill.) Pers.: ***Lophochloa cristata** (L.) Hylander; see Simon, *A Key to Queensland Grasses, Technical Bulletin* No. 4 (1980).

S *Leptospermum grandifolium* Sm.: **L. lanigerum** (Ait.) Sm.; The author and others do no regard the former as a good species.

S *Luzula australasica* Steud.: **L. modesta** Buchenau; see Jansen, *Blumea* 24: 527-532 (1978).

S *Luzula oldfieldii* Hook.f.: **L. australasica** Steud.; see Jansen *ibid.*

S *Lycopodium varium* R.Br.: **L.myrtifolium;** In the unpublished list (for Forests Commission of Victoria) of 507 species of indigenous Victorian plants, which are variously rare, very localized and/or endangered, J.H. Wills records the latter name for this species.

S **Lycopsis arvensis* L.: ***Anchusa arvensis** (L.) Bieb.; see *9:*108.

S *Melothria micrantha* (F.Muell.) F.Muell. ex Cogn.:**Z ehneria micrantha;** In the unpublished list (for Forests Commission of Victoria) of 507 species of indigenous Victorian plants, which are variously rare, very localized and/or endangered J.H. Willis records the latter name for this species.

S **Myosotis caespitosa* C.F. Schultz.: ***M. laxa;** *see 9:*116.

S **Notelaea ligustrina* Vent.: **Nestegis ligustrina**

(Vent.) L. Johnson; NSW pers. comm.; see *12:* 518.

\+ **Notelaea venosa** Vent; plus **N. longifolia** Vent.; see *1:* 415. The latter occurring along lower Wingan River; P. Smith pers. comm.

S, + *Ophioglossum coriaceum* A. Cunn.: **O. lusitanicum** L.; see *2:* 47; plus **O. petiolatum** Hook. which also occurs in Victoria; M. Robinson pers. comm.

S *Oxalis lactea* Hook.: **O. magellancia** Forst. f.; see Veldkamp, *FL. Males.*, ser. 1,7: 156-$57 (1971).

S *Pachycornia tenuis* (Benth.) J. M. Black: **Sclerostegia tenuis** (Benth.) P. G. Wilson; see Wilson *Nuytsia* 3: 22 (1980).

— Paspalidium gracile (R.Br.) D. K. Hughes: all Victorian records belong to **P. constrictum** (Domin) C. E. Hubbard; NSW pers. comm.

S *Pentatropis quinquepartita* (F. Muell.) Benth.: **Rhyncharrhena linearis** (Decne.) K. L. Wilson; see Wilson *Telopea* 2(1) (in press).

— Potamogeton lucens L.; Apparently some doubt about identity; NSW pers. comm.

S *Prasophyllum gracile* R. S. Rogers: **P. fuscum** R.Br.; see *2:* 429-431.

S *Prasophyllum odoratum* R. S. Rogers: **P. patens** R.Br.; see *2:* 434.

C Prasophyllum sp. (see Beauglehole, Vict. Nat. 95: 72): **P. rufum** R.Br.; see *2:* 435.

S **Romulea longifolia* (Salisb.) Baker: ***R. rosea** (L.) Eckl.: see deVos, *J. S. African Bot.*, Suppl. 9:254 (1972).

S *Salicornia blackiana* Ulbrich: **Sarcocornia blackiana** (Ulbrich) A. J. Scott; see Scott *J. Linn. Soc.* 75; 357-374 (1977).

S *Salicornia quinqueflora* Bunge ex Ungern-Sternberg: **Sarcocornia quinqueflora** Bunge ex Ung.-Sternb.) A. J. Scott; see Scott *ibid.*

— *Senecio orarius* J. M. Black: Hybrids among Senecio species have been witnessed and collected on numerous occasions. The author is convinced that *S. orarius* is such a case with **S. lautus** Forst.f. ex Willd. as one of the parents. M. Lawrence pers. comm. is of the same opinion.

S **Solanum nitidibaccatum* Bitt: ***S. sarrachoides** Sendt.; see Edmonds *Bot. J. Linn. Soc.* 78; 213-233 (1979).

S *Solanum nodiflorum* N.J. Jacq.: **S. americanum** Mill.; see Edmonds *J. Arnold Arb.* 52: 634-635 (1971).

S **Solanum ottonis* Hylander: ***S. chenopodioides** Lam.; see Edmonds *Bot. J. Linn. Soc.* 78: 213-233 (1979).

—, C, + Solenogyne bellioides Cass.: A recent review of the Genus Solenogyne has revealed that S. bellioides does not occur in Victoria, but instead **S. dominii** L. G. Adams and **S. gunnii** (Hook.f.) Cabrera; see: Adams, *Brunonia* 2: 43-65 (1979).

S *Sonchus hydrophilus* Boulos: ***S. asper** (L.) Hill forma **hydrophilus** (Boulos) Koster; see Koster, *Blumea* 23: 165 (1976).

S *Stipa compacta* D. K. Hughes: **S. flavescens** Labill.; see Townrow, *Proc. R. Soc. Tasmania* 112: 227-287 (1978).

S *Stipa elatior* (Benth.) D. K. Hughes: **S. flavescens** Labill.; see Townrow *ibid.*

S *Stipa pubescens* R.Br.: **S. pubinodis** Trinius & Ruprecht; see Townrow *ibid.*

S *Stipa teretifolia* Steud: **S. stipoides** (Hooker.f.) Veldkamp; see Townrow *ibid.*

\+ **Stylidium calcaratum** R.Br.: plus **S. ecorne** (F. Muell. ex Erickson & Willis) Farrell & James; see Farrell and James, *Aust. J. Bot.* 27: 39-45 (1979).

S,C *Thelymitra megcalyptra* R. D. FitzG. (see Beauglehole, *Vict. Nat.* 95: 73): **T. longifolia** Forst. & Forst.f; see *2:* 459.

S *Thelymitra nuda* R.Br.; **T. longifolia** Forst. & Forst.f.; see *2:* 459.

S *Thelymitra rubra* FitzG.: **T. carnea** R.Br.: see *2:* 454, 455.

S *Trymalium ramosissimum* J. W. Audus: **T. daltonii** F. Muell.; The author now regards this as synonymous; see Beauglehole, *Vict. Nat.* 95, No. 2: 73 (1978).

C + **Utricularia dichotoma** Labill. (see: Beauglehole, *Vict. Nat.* 95: 73). The author's observations show that the plant with usually several large royal purple flowers with about seven yellow stripes at base of 'apron' be attributed to **U. dichotoma.** The other with 1-3 smaller blue-purple flowers with 3 yellow stripes be attributed to **U. uniflora** R.Br.; see *4:* 431.

S *Wahlenbergia quadrifida* (R.Br.) Alph.: *W. gracilis* (Forst.f.) Alph. DC. R. Carolin & P. Smith pers. comm.

S *Wahlenbergia tadgellii* N. Lothian: **W. multicaulis** Benth.; R. Carolin & P. Smith pers. comm.

NOTE: The following Family name changes are also necessary.

COMPOSITAE: **ASTERACEAE**
CRUCIFERAE: **BRASSICACEAE**
GRAMINEAE: **POACEAE**
LABIATAE: **LAMIACEAE**
PAPILIONACEAE: **FABACEAE**
UMBELLIFERAE: **APIACEAE**

Additions to the vascular flora of Victoria

New names listed are followed by their author and place of publication; new records of already known plants are followed wherever possible by a reference to a relevant text giving description of the plant. References to periodicals appear in the main text; references to books are cited by numbers in italics and full titles appear in bibliography. Distributions are shown

according to the Victorian plant mapping grid system (A to Z).

* Species introduced into Victoria.

Agrostis adamsonii Vickery in *Contrib. N.S.W. Nat. Herb.* 1 (3): 107 (1941); see also Simon, *Bot. Branch Tech. Bull.* 3: 4 (1978) and *11:* 148 **N.**

Agrostis aequata Nees; see Simon *ibid* and *11:* 143 (as a slight variant of **A. rudis** Roem. & Schult.) **EK.**

***Amaranthus powellii** S. Watson; A. Kanis pers. comm. has identified several collections as this species **ENUVWYZ.**

Ammobium alatum R.Br. ex Sims in Curtis's *Bot. Mag.* t. 2459 (1824) **V.**

Apium annum P. S. Short in *J. Adelaide Botanic Gardens* 1 (4): 230-234 (1979) **CEJKNP.**

Aristida browniana Henr.; see *2:* 132 **F.**

***Avena strigosa** Schreb.; see Simon, *Bot. Branch Tech. Bull.* 3:17 (1978) and *11:* 125 **JN.**

Bursaria lasiophylla E. M. Bennett in *Nuytsia* 2 (4): 192 (1978) **AHJVW.**

***Catapodium marinum** (L.) C. E. Hubbard; R. F. Parsons pers. comm. informs that a collection checked by B. K. Simon is housed at MEL **P.**

Cheiranthera alternifolia E. M. Bennett in *Nuytsia* 2 (4): 197 (1978) ? **B.**

***Conyza? floribunda** Humb. et al., Nova Genera & Spec. P1.4: 73 (1820) **CDEHJKMNRUV.**

NOTE: Since Todd, *Muelleria* 4(2): 182 (1979) MEL pers. comm. informs that there is some doubt regarding the name C. floribunda.

Correa backhousiana Hook. in *J. Bot.* 1: 253 (1834) **K.**

***Cyrtomium falcatum** (L.f.) C. Presl. *Tentamen Pterid.* 86 (1836) **R.**

Daviesia arenaria M. D. Crisp. in *J. Adelaide Bot. Gard.* 2(2): 163-166 (1980) **ABCDFG.**

Digitaria hystrichoides Vickery in *Contrib. N.S.W. Nat. Herb.* 1(6): 324 (1951); see Simon, *Bot. Branch Tech. Bull.* 3: 41 (1978) and *11:* 197 ? **A.**

Discaria nitida Tortosa in *Hickenia* 1: 109-111 (1977) **W.**

Elytrophorus spicatus (Willd.) Camus; see Simon, *Bot. Branch Tech. Bull.* 3:23 (1978) and *11:* 163 **C.**

Eragrostis benthamii Mattei; see Simon *ibid* 3: 27 (1978) and 4:53 (1980) Grid unknown to present author.

***Eschscholzia californica** Cham.; see *12:* 162 **WZ.**

Gonocarpus montanus (Hook.f.) Orchard; see *8* 172-176 **RSVWYZ.**

Goodenia bellidifolia Sm. in *Trans. Linn. Soc.* London 2:349 (1794) **Z.**

***Hakea suaveolens** R.Br. in *Trans. Linn. Soc. London* 10: 182 (1810) **E.**

Haloragis eichleri Orchard; see *8:* 88-90 **E.**

***Hydrocleys nymphoides** (H. & B. ex Willd.) Buch.; see Aston and Jacobs, *Muelleria* 4(3): 285-293 (1980) **W.**

***Juncus fontanesii** Gay in Laharpe *Monogr. Jonc.:* 130 (1827) **K.**

Mirbelia rubiifolia (Andr.) G. Don; see *1:* 281 **Z.**

***Moraea aristata** (Houtt.) Aschers. & Graebn.; see *11:* 343 **J.**

Myriophyllum sp. (A): E. A. Orchard pers. comm. **BM.**

Myriophyllum sp. (B): E. A. Orchard pers. comm. **JK.**

***Najas marina** L.: see Aston, *Vict. Nat.* 96: 67-69 (1979) **Z.**

Notelaea longifolia Vent.; see *1:*415 **Z.**

***Paspalum dasypleurum** Kunze ex Desvaux; see Simon, *Bot. Branch Tech. Bull* 3: 42 (1978) **N.**

***Paspalum urvillei** Steud; see *11:* 199; the present author recently witnessed spreading colonies near Walwa in Grid U50 (Collection ACB 68461, 16 May 1980 — MEL and author's private herbarium) **U.**

***Petrorhagia nanteuillii** (Burnat) Ball et Heywood: see *1:* 170 **R.**

Phyllanthus trachyspermus F. Muell.; see: *3:* 510. **A.**

***Plantago australis** Lamk.; in *Flora of N.S.W.* 181: 11 (1977) Briggs et al records this species as naturalized for Victoria **KN.**

***Pontederia cordata** L.; see Aston, *Vict. Nat.* 96: 67-69 (1979) **D.**

Prostanthera incana A. Cunn.; see: *1:* 515 **W.**

Prostanthera sp. aff. decussata; J. Carrick pers. comm. **N.**

***Salix alba** L.; see *12:* 24 **DEJKNPRVWZ.**

Sclerolaena intricata (R. H. Anderson) A. J. Scott; Syn. *Bassia intricata* R. H. Anderson; see Scott, Dept. of *Plant Biology, Univ. of Birmingham,* Birmingham, Great Britain: 101-119 (1978) **A.**

Solanum adenophorum F. Muell. in *Fragm. Phytogr. Austr.* 2:162 (1860-61) **H.**

Solanum coactiliferum J. M. Black in *Trans. R. Soc. S. Aust.* 33: 224 (1909) **F.**

Solanum petrophilum F. Muell.; see 12: 554 **H.**

Solenogyne dominii L. G. Adams in *Brunonia* 2:43-65 (1979) **CDEJKMNPS.**

Solenogyne gunnii (Hook.f.) Cabrera; see Adams *ibid.* **EVWZ.**

***Soliva anthemifolia** (Juss.) R.Br. ex DC.; MEL pers. comm. 3 July 1980, has supplied the following: 'one of your recent collections, ACB 63962 from near Murray River, Grid Q37, 4 June 1979, has been identified as **Soliva anthemifolia** (Juss.) R.Br. ex DC. This is yet another new record for Victoria' **U.**

***Sorghum bicolor** (L.) Moench; A collection, ACB 63772, 24 Jan. 1979, from Stony Rises near Colac in Grid K14 was determined by B. K. Simon and now housed at MEL. BRI and the author's private herbarium **K.**

Stipa sp. (A); J. W. Vickery pers. comm. **C.**

Stipa densiflora Hughes; see *1:* 53 **MRSVWZ.**

Stipa falcata Hughes; see *1:* 53 **ABCFGHMRVW.**

Stipa sp. (B); J. W. Vickery pers. comm. **C**

Stipa mundula J. M. Black; see *2:* 108 **C.**

Stipa nodosa S. T. Blake; see *2:* 108 **C.**

Stipa oligostachya Hughes; see Hughes, *Kew Bull. Misc. Inf.* 12 (1921) **CD.**

Stipa scabra Lindl.; J. W. Vickery pers. comm.

determined several collections as this species **BVWYZ.**

Stipa stuposa Hughes, see Townrow, *Proc. R. Soc. Tasmania* 112: 227-287 (1978) **CDW.**

Stipa tenuiglumis Hughes; see *2:* 111 **EK.**

Stuartina hamata W. R. Philipson; see 1: **F.**

Stylidium ecorne (F. Muell. ex. Erickson & Willis) Farrell & James; see Farrell and James, *Aust. J. Bot.* 27: 39-45 (1979) **CDJRS.**

Utricularia monanthos Hook.f.; see *7:* 339; The present author has collected this dwarf species north of Mt. Cope in the Bogong High Plains in Grid V47 — ACB 15489, 26 Jan. 1966 (MEL and the author's private herbarium) **V.**

Zostera capriconi Aschers; see Jacobs & Williams, *Telopea* 1 (6): 451-455 (1980) **Z.**

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Acacia notabilis — First Records for Victoria

Recent field work in the Mallee region of north-west Victoria (since published as 'Fire in the National Parks of North-West Victoria' by P. D. C-Cheal, J. C. Day and C. W. Meredith; National Parks Service, 1979) required the preparation of a vegetation classification based on floristic data collected on a quadrat basis. In two of the 10m x 10m quadrats for which full species lists were prepared a problematic *Acacia* sp. occurred. Specimens were taken and pressed for later identification.

As some difficulty was experienced identifying the specimens, they were sent to the National Herbarium, Victoria (MEL) for identification. They were later returned unnamed, with the note ". . . doesn't match anything in the Victorian reference set." After further investigation, including comparison with the type held at MEL, I have concluded that the specimens are *Acacia notabilis* F. Muell. These are the first records of this species for Victoria.

Locality

The plants were found in two localities in the far west of the Sunset Country:—

(a) 10 minute grid A38, at grid reference 433714 on the 1:250 000 map series, Mildura sheet SI 54-11. Collected 25.10.1978.

(b) 10 minute grid A39, at grid reference 446713 on the 1:250 000 map series, Mildura sheet SI 54-11. Collected 13.10.1978.

Habitat

(a) Open shrubland, dominated by *Eucalyptus gracilis/Eucalyptus socilis,* to 3.5m tall and 40% canopy cover above an open shrub layer of *Acacia notabilis,* to 1.6m tall and 25% canopy cover, with a low open (15% canopy cover) shrub layer of predominantly *Beyeria opaca.* The red loamy clay of this broad interdune flat was stabilised by a more or less continuous crust of mosses and lichens.

(b) Open shrubland, dominated by *Eucalyptus calycogona,* to 3m tall and 30% canopy cover above an open shrub layer of *Acacia notabilis,* to 2m tall and 15% canopy cover, with a low open (15% cover) field layer of a variety of small ephemeral herbs (notably *Calotis hispidula, Crassula* spp., and *Plantago turrifera*) and perennial *Stipa* spp., *Bassia diacantha* and *Maireana pentagona.* The brown clay loam (again a broad inter-dune flat) was stabilised by an almost continuous crust of lichens and mosses.

Species common to both sites were *Bassia diacantha, Beyeria opaca, Brachyscome*

Figure 1.
Speciment of *Acacia notabilis* F. Muell.

lineariloba, Calotis hispidula, Crassula colorata, Helipterum pygmaeum, Maireana pentagona and *Stipa elegantissima*.

The habitat agrees closely with that described for the species in Whibley (1980), p.122 viz. ". . . open scrub vegetation. Soils; mainly brown or shallow calcareous, hard alkaline red duplex."

Description

A. notabilis is readily distinguished from all other *Acacia* spp. recorded from north-western Victoria by the very broad (app. 1cm) legumes containing *transverse* seeds, *encircled* by a very long funicle. In addition, it is readily separable from the only other tall, broad-foliaged *Acacia* spp. of the region (i.e. *Acacia hakeoides* and *Acacia pycnantha*) by the prominent thickened yellow margins to both the phyllodes and the legumes.

Acacia notabilis F. Muell. is a tall glabrous shrub to 3m. tall. The branches are terete with a smooth reddish-brown bark. The oblong lanceolate to rhomboid, somewhat glaucous phyllodes are 5 to 15 cm long and 5 to 25mm broad with a prominent mid-vein, numerous fine lateral veins and a prominently thickened yellow margin. The apex is more or less obtuse and there is a gland on the upper margin just above the short, wrinkled peduncle. Inflorescences are axillary racemes shorter than the phyllodes with 45 to 60 flowers per head, followed by narrowly oblong legumes 3 to 7 cm long and about 1 cm broad. The margins are thickened and the pods are raised over the transverse seeds, which are almost completely encircled by the long funicle. Flowering time of the Victorian plants is unknown but young legumes were present on specimens collected in late October. The species also occurs in New South Wales, South Australia and Western Australia.

Acknowledgements:

The Staff of the National Herbarium (Victoria) kindly provided access to various specimens kept in the collection there, including the type(s).

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Preliminary Notice
Ideas for Ornithological Research in the Eighties

VORG Conference
Melbourne, 24 — 26 July 1981

The Victorian Ornithological Research Group will be holding a Conference in Melbourne over the weekend 24 — 26 July 1981, on the theme of Ideas for Ornithological Research in the Eighties.

If the price of petrol continues to rise, the title may be Bird Study Close to Home — which would then be another way of expressing the theme.

All interested persons are invited to attend the Conference. It is hoped that further details will appear in a later issue of this journal; in any case they may be obtained from the address below.

VORG Conference Secretariat
P.O. Box 203
South Melbourne, 3205

Rosemary Balmford
Secretary, VORG.

Inside the Burrow of the Common Wombat, *Vombatus ursinus* (Shaw 1800)

By J.C. McIlroy*, R. J. Cooper* and E. J. Gifford*

Introduction

The common wombat, *Vombatus ursinus* (Shaw 1800) is a large, herbivorous marsupial which inhabits the forest-covered, mountainous areas of south and south-eastern Australia. One of its best-known habits is its excavation and use of burrows for diurnal shelter. To date, though, little is known or has been published about the burrows, including their internal structure.

Nicholson (1963) whilst a schoolboy, crawled into several wombat burrows and sketched their layout. McIlroy (1973) examined 197 wombat burrows and, based on their length, classified them into three types — minor, medium and major burrows. Each type differed considerably in their physical and environmental characteristics, patterns of use and function. McIlroy also crawled into each burrow but, because of his size, was not able to fully examine many of the burrows over their entire length.

During July and August, 1979, we had the opportunity to examine the interiors of seven wombat burrows. As part of an extensive research programme on the effects of vertebrate pest control campaigns on non-target animals, we had radio-tracked 12 wombats which we had dosed with 1080 poison (sodium fluoroacetate). Eight of the wombats subsequently died, all within their burrows. Consequently, to recover the transmitters, we excavated seven of the burrows; excavation of the eighth burrow, however, was not a practical proposition. This paper describes our observations on the internal structure of these seven burrows.

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Methods

The study area was situated in the Bondo State Forest, near Tumut, New South Wales. Five burrows were in 4 and 8 year old plantations of *Pinus radiata* established after the original native eucalypt forest had been clear-felled and the other two burrows were situated in adjacent retention areas of native forest. Six of the burrows were situated in red earth, the most common soil in the area. The seventh burrow was in a stony, granitic soil.

Initially we began removing all the soil above the burrow but this soon proved impracticable so we simply dug 1-4 shafts, up to 2.2 m deep, along the route of the burrow until we eventually located the wombat. Because of the physical effort involved no further shafts were dug after this, even though six of the burrows continued onwards. All burrows were examined by torchlight from the entrance and bottom of each shaft and the presence and dimensions of resting chambers were recorded, including their distance from the burrow entrance. Other measurements taken were the dimensions of the entrances and the tunnels at shaft sites, the depth of the tunnels below the ground at shaft sites and the length of each tunnel, as far as possible. In most cases the total length of the burrow could not be measured. The length and girth of each wombat was also obtained prior to its ingestion of poison.

Results

The seven burrows varied in length from over 7.0 m to over 17.9 m (Table 1). Their single, inverted U-shaped entrances ranged between 31-65 cm in height and 37-49 cm in width. Tunnel

Table 1. The internal measurements of seven common wombat burrows.

Entrances				Tunnels (range)			
Length (m)	Height (cm)	Width (cm)	Area** (m^2)	Depth* (m)	Height (cm)	Width (cm)	Area** (m^2)
7.2	31	47	0.19	0.3-0.4	20-26	39-43	0.10
7.9	32	41	0.17	0.3-0.9	27-29	35-36	0.12
7.0	65	37	0.32	0.3-0.9	25-32	27-28	0.09
16.7	42	46	0.25	0.4-1.8	23-27	28-36	0.08
17.9	40	47	0.25	0.4-1.3	24-28	32-35	0.10
8.3	35	49	0.22	0.2-1.5	18-28	23-39	0.06
10.1	44	47	0.27	0.8-2.2	—	—	—

Resting chambers					
.Distance from entrance (m)	Depth* (m)	Height (cm)	Width (cm)	Length (cm)	Area** (m^2)
(a) 1.9	0.4	—	—	—	—
(b) 4.0	—	—	—	—	—
(a) 4.5	—	25	57	78	0.19
(b) 6.8	—	—	—	—	—
(a) 4.8	0.9	31	49	65	0.20
(a) 5.3	1.5	35	50	95	0.23
(b) 10.3	1.8	41	50	106	0.27
(a) 2.6	0.8	34	56	100	0.25
(b) 5.8	—	35	55	108	0.25
(a) 6.2	—	—	—	—	—
(a) 3.1	1.1	35	49	81	0.23
(b) 8.8	2.2	36	59	130	0.28

*Depth of soil above tunnel or resting chamber;
(a) = anterior chamber, (b) = second chamber
— = No data recorded.

**Areas based on area of a parabolic segment = 2/3 (2a)h where 2a = width and h = height.

heights ranged between 17.5-32 cm and widths between 23-43 cm. Two of the burrows divided into separate tunnels 1.5 m and 4 m from the entrances, respectively. In the first burrow one tunnel continued for more than 4.7 m while the other tunnel ended abruptly after a further 2.9 m. In the second burrow both tunnels extended on for at least another 5.5 m and 6.1 m, respectively.

The slope of the ground the burrows were dug into and the direction they followed varied considerably. Five burrows, dug into relatively flat to moderately sloping ground continued directly onwards while another two, dug into moderate slopes, turned shortly after the entrances and extended across the slopes. The slope of the tunnels also varied. Three tunnels were initially level but then either gradually sloped upwards or downwards. Another three initially sloped downwards but then levelled off or rose and then descended again. One tunnel steadily rose from the entrance onwards, parallel with the slope above it.

Each burrow contained at least 1-2 resting chambers. These were enlarged, scooped-out oval sections of the tunnels, varying considerably in size (height 25-41 cm, width 49-59 cm, length 65-130

cm). The most anterior chambers were located 1.9-6.2 m from the entrances, either in direct line or just after a gentle bend or fork. The next chambers were situated a further 1.5-5.0 m in (i.e. 4.0-10.3 m from the entrances), generally in the same stretch of tunnel as the anterior chamber. The one exception occurred just after the burrow abruptly changed direction. The depth of soil above the chambers and the deepest points of excavation varied from 0.4-2.2 m. One anterior resting chamber contained a layer of eucalypt twigs and leaves, a common bedding material (McIlroy 1973), but the other 11 chambers examined were unlined. Three of the dead wombats were found in the anterior chambers, two in the next chambers, one 11.8 m in, past two chambers and the seventh animal 16.7 m in, at the end of the burrow. Each wombat was found lying on its chest.

Rabbits, *Oryctolagus cuniculus*, also sheltered in the burrows and, in two instances, had excavated smaller tunnels into the wall 0.2 m inside the entrance and 16.7 m in, at the end of the burrow. No other vertebrates were found in the burrows, although McIlroy (1973) listed foxes, *Vulpes vulpes*, mountain possums, *Trichosurus caninus*, echidnas, *Tachyglossus aculeatus*, and bush rats, *Rattus fuscipes*, as other inhabitants of wombat burrows.

Discussion

Although there are larger animals in the world that dig or shelter in subterranean holes, such as the aardvark, *Orycteropus afer*, and warthog, *Phacochoerus aethiopicus*, the common wombat is still a remarkable animal in regard to its burrowing ability. The seven burrows we examined, for instance extended for more than 7-17.9 m, involving the excavation of approximately 0.6-1.8 m^3 of soil. McIlroy (1973) recorded 197 burrows measuring between 0.3-19.5 m in length while Troughton (1957) mentions one burrow 29.5 m in length. The cross-sectional area of the entrances to the burrows were also quite large (0.17-0.32 m^2 for our 7 burrows, 0.12-0.26 m^2 for the 197 measured by McIlroy 1973). The actual tunnels, though, were much smaller (0.06-0.12 m^2) and just large enough for a wombat to move along. (The cross-sectional area of an adult wombat, based on the area of a circle, is approximately 0.04-0.05 m^2, excluding the legs). The resting chambers, in comparison, were much larger in cross-sectional area (0.19-0.28 m^2) than the tunnels.

It is clear from the work of Wells (1978) that the resting chambers have an important role in the thermoregulation and activity rhythms of the hairy-nosed wombat, *Lasiorhinus latifrons*. Wells did not record air temperatures deep within the burrows in his semi-arid study area but soil temperatures, measured approximately 1 m below the ground surface and 3 m in from the burrow entrances, remained relatively constant throughout the year. In contrast, air temperatures within the antechambers and just outside the burrow entrances fluctuated widely throughout the year, with marked daily and seasonal gradients present. According to Wells, when a wombat returns to a burrow after a night's activity, it retreats into the depths of the burrow. Later (e.g. the next afternoon) it moves up the burrow towards the entrance but if it encounters unsuitable (e.g. higher) air temperatures, it retreats again. If the air temperature is not markedly different from that in the depth of the burrow, such as during a dull day, it rests in a chamber within the 'twilight' zone, about 3 m in from the entrance. It then emerges when either light intensity (e.g. during winter) or air temperatures (e.g. during summer) are suitable for activity. This generally occurs after sunset but may occur during dull daylight.

Less is known about the role of the resting chambers in the ecology of the

common wombat. G. Brown (pers. comm. 1980) has found that ambient temperatures just within their burrow entrances vary widely but after about 4 m inside a burrow air temperature and soil temperature are almost equal. In contrast to the hairy-nosed wombat burrows, he found that soil temperatures approximately 1 m below the ground surface (and thus probably air temperatures deeper inside the burrow) varied throughout the year. At Bondo, such variation is likely to be from 8-20°C.

Nicholson (1963) believed that the common wombat's movements within burrows were directly related to light intensity. On bright, sunny days he found wombats deep down inside the burrows. On less bright days they were often found closer to the burrow entrance while on very dull days they were usually present in the half-light, just inside the burrows, or sometimes were active above ground. McIlroy (1973) made similar observations but believed that air temperatures also governed activity rhythms. Possibly, as with the hairy-nosed wombat, both light intensity and air temperature are involved in determining emergence and re-entry times for the common wombat and the 'nests' Nicholson (1963) found 1.8-4.9 m inside burrows, the 35 chambers McIlroy (1973) located within the first 0.9-7.3 m of 33 burrows and the 12 chambers we located 1.9-10.3m from the entrances represent 'sensing posts' where a wombat can 'lie-up' and wait until conditions are suitable for above-ground activity.

Some of the chambers, particularly the posterior ones, may also have other functions. Nicholson (1963), for example, relates how adult female wombats make simple nurseries of bracken fronds and bark at the end of tunnels. He also described how a wombat entering a deserted burrow or one containing a dead wombat would dig a new chamber about 2.7 m from the old chamber and line this with bracken fronds and bark. Chambers used by females were apparently always slightly larger and better lined than those used by males. Of the chambers (or tunnels) examined by Nicholson (1963), McIlroy (1973), or those reported here, none appeared to have been used as 'sanitary chambers' for deposition of faeces, as occurs with some semi-fossorial mammals (e.g. rodents).

Internal division of burrows does not appear to be common. Nicholson (1963) found one burrow that divided 2.1 m in from the entrance into two tunnels 4.4 m and 8.2 m long, respectively, while McIlroy (1973) found 12 burrows that divided in a similar manner. The reason for such divisions is not clear. Nicholson (1963) remarked that if a wombat found a deserted burrow containing a dead wombat it may dig another tunnel. Young wombats, while learning to dig, also gradually excavate their own small tunnels inside their mothers' burrow. It appears then that over many years some of these tunnels are excavated further, finally linking up with other tunnels, either within the same burrow or with tunnels from adjacent burrows, to form a complex network of inter-connecting tunnels and entrances.

In conclusion, one must be impressed by the simplicity of construction but sophisticated function of a wombat burrow. In essence it is simply a long tunnel dug into the ground that is sufficiently large enough for a wombat to move along and yet, with its series of resting chambers, it provides not only a secure haven from predators, bushfires and other perils above ground but also a means by which individuals can avoid problems with thermoregulation and emerge when climatic conditions are suitable.

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A Key To Some Gasteromycete Genera Commonly Found In South-eastern Australia

Since the publication in 1944 of G. H. Cunningham's *Gasteromycetes of Australia and New Zealand* much work has been carried out upon this class of the fungi; new genera have been erected and new combinations made. *The Key To Families and Important Genera Of The Lycoperdales* by D. M. Dring in *The Fungi IVB*, published in 1973, incorporates many of these modern taxonomic concepts. The following key, coupled with the species descriptions in Cunningham's work, should assist in the identification of the 'puffballs' most commonly found in this Botanic region.

The key is confined to the Lycoperdaceae and certain monotypic genera not yet recorded for this region have been omitted.

Lycoperdaceae.

Fruit bodies mostly terrestrial, some on wood; exoperidium of one layer, often caducous; spore sac dehiscing by apical pore or by attrition from above; capillitium septate or not, typically branched, hyaline or tinted; spores mostly globose, brown, smooth, spiny or warted, occasionally reticulate.

1. Exoperidium a sand case 2
1. Exoperidium not a sand case 3
2(1) Spores strongly reticulate; exoperidium dehiscing by falling away from above ..... *Abstoma*
2(1) Spores not reticulate; exoperidium caducous except for a small basal disc; endoperidium tough with definite apical stoma ..... *Disciseda*
3(1) True capillitium abundant 4
3(1) True capillitium absent; paracapillitium abundant 9
4(3) Sterile base absent or virtually so or fibrous 5
4(3) Sterile base cellular, prominent 7
5(4) Apical stoma absent 6
5(4) Apical stome present ..... *Bovista*
6(5) Exoperidium and endoperidium falling away ..... *Langermannia*
6(5) Endoperidium thick, tough, splitting stellately; capillitium strongly spined ..... *Mycenastrum*
7(4) Stoma present 8
7(4) Stoma absent; dehiscence by falling away of upper part of peridium; sometimes a tough zone between gleba and sterile base, not a true diaphragm ..... *Calvatia*
8(7) Capillitium free within peridium with well marked main stem, (bovistoid) much branched; pseudocolumella poorly developed ..... *Bovistella**
8(7) Usually on ground, some on wood; capillitium simple or slightly branched; well marked pseudocolumella ..... *Lycoperdon*
9(3) Diaphragm present. Peridium falling away from apex; true capillitium absent or peripheral only; spores smooth or minutely warted ..... *Vascellum*
9(3) Diaphragm absent. Gregarious on dead wood, highly coloured; true capillitium absent; endoperidium falls aways in patches; spores globose, echinulate ..... *Morganella*

**Bovistella* — not so far recorded in Victoria.

Glossary

Diaphragm: strong, smooth, parchment like surface to a sterile base separating it from the fertile gleba. Not to be confused with a toughened zone present in some specimens.

Paracapillitium: mostly hyaline hyphae occurring in the gleba of some Lycoperdales and which readily takes up cottonblue from cold lactic acid solution, as defined by Kreisel (1942).

True capillitium: thick walled, pigmented, hollow, mostly branched hyphae which does not readily take up cotton blue from cold lactic acid solution.

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G. A. Crichton

Enigmatic Organic Structures in the Grampians Group Sediments

BY J.G. DOUGLAS AND P.R. KENLEY*

A field inspection of unusual structures in the sandstone of Mount William, Grampians Ranges was made by Dr D. Spencer-Jones, Dr J.G. Douglas (Geological Survey of Victoria) and Mr T.A. Darragh (National Museum of Victoria) in 1972. Later the site was revisited separately by the writers. This interesting occurrence was kindly brought to notice by Mr Peter Smith of Canberra.

At the time of the first visit there was a near blizzard on the top of the mountain and the structures were difficult to locate (Fig 1). They proved to be siliceous bodies, up to 2 m in length and semi oval in cross section, varying in width up to 200 mm and depth 100 mm. They are straight or slightly curved, lying on the bedding planes of gently dipping cross bedded sandstone. Nineteen specimens whose orientation could be determined were found to be aligned in the sector NNE-SE. In many cases much of the body is exposed (Fig 2) and occasionally one extremity is completely free from the surrounding rock, forming a log-like projection. The bases are flattened and on some specimens there is a regular pattern, particularly evident on the upper surface, with thick crescentic, semi overlapping scales or tubercles, 1-2 cm in length. A few show weakly developed longitudinal ribbing.

The uneven and vegetated nature of the exposure makes assessment of numbers difficult but there are about 50 specimens in various stages of preservation over an area of 2-3 hectares. They are widely dispersed but tend to occur in clusters of 4-6, distributed through a narrow stratigraphic interval.

Stratigraphically the structures are in the lowermost unit of the Red Man Bluff Sandstones. They have been compared with cylindrical concretions from several localities west of Apollo Bay in the Lower Cretaceous Otway Group (Medwell 1977). The Otway Group concretions have a more evident concretionary appearance, greater size range within the one locality, more consistent orientation, and perhaps more importantly, show no surface ornamentation or basal flattening. It is largely because of these latter features that we regard the Grampians structures as fossils, not sedimentary concretions, and one of us (JGD) suggests affiliation with the Nematophytales, a group including emigmatic fossils many of which

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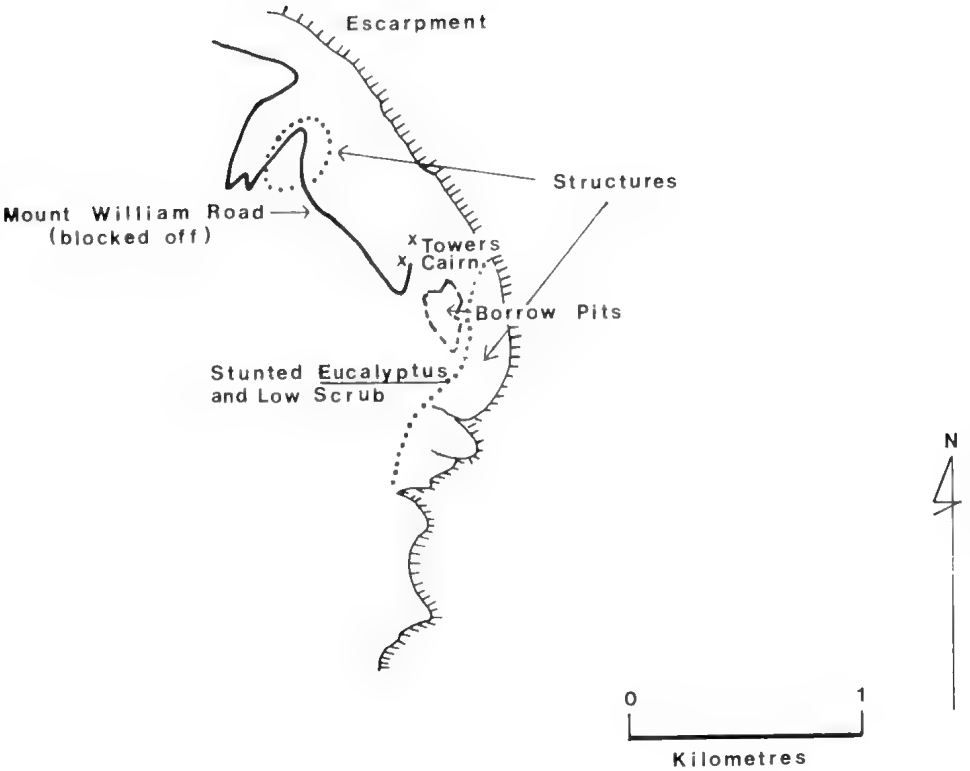

Fig.1 Mount William, Grampians

are regarded as brown algae (Phaeophyta). Larger log-like bodies were described by Dawson (1859) from Lower Devonian beds on Gaspe Peninsula, Canada, and called *Prototaxites*. *Prototaxites* consists of a system of tubes of two sizes, but numerous thin sections of the Grampians specimens failed to reveal a definite internal anatomy.

There can be no question of identification with either present or past trees which might have yielded similar "logs", as the Grampians sediments are of Late Silurian or earliest Devonian age, (Spencer-Jones 1976), and were laid down before the development of large land plants. In fact, the well-known *Baragwanathia* flora of central Victoria,

Fig. 2. Log-like structure, Mount William, Grampians. Photo: P.R. Kenley

containing some of the earliest land plants, was probably contemporaneous.

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A New Macropod Species of the Grampians

BY P.R. BIRD*

Five species of macropods have been listed by Wakefield (1974), Seebeck (1976) and Emison *et al.* (1978) for the Grampians ranges. These are:

Macropus giganteus (Eastern Grey kangaroo)

M. fuliginosus (Western Grey or Mallee kangaroo)

M. rufogriseus (Red-necked wallaby)

Petrogale penicillata (Brush-tailed Rock Wallaby)

Potorous tridactylus (Potoroo).

The Western Grey is usually seen in open woodland or grassland flats, particularly in the Black Range and Victoria Valley area. The dark brown fur usually serves to differentiate it from the Eastern Grey kangaroo, which may be seen with it in these locations. The Eastern Grey occurs more widely throughout the ranges and foothills, together with the Red-necked wallaby. The Brush-tailed Rock Wallaby colony in the Victoria Range was described by Wakefield (1971). The population of this wallaby is small and disturbance of its environment by visitors and an army cadet corps which used a nearby area for training, may have endangered it. The Potoroo too has a limited distribution — Pomonal area — and its status may also be uncertain since part of its known range is on free-hold land subject to alienation.

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Sub-fossil evidence reveals that the following species were also once present in western Victoria (Wakefield 1974; LCC (1978) report):

Bettongia gaimardi (Southern bettong)

B. penicillata (Woylie)

B. lesueur (Boodie)

*Macropus greyi** (Toolache wallaby)

*Lagorchestes leporoides** (Brown hare wallaby)

Thylogale billardierii (Red-bellied wallaby)

Aepyprymnus rufescens (Rufous rat kangaroo)

Onychogalea unguifera (Northern nail-tailed wallaby)

O. fraenata (Bridle nail-tailed wallaby)

Megaleia rufa (Red kangaroo)

Wallabia bicolor (Swamp or Black wallaby)

(* believed to be extinct).

The Southern bettong once occurred in the Grampians (Wakefield 1974) whilst the sub-fossils of this species and the others variously occurred in the Lower Glenelg, Tower Hill, Byaduk Caves and Mt. Hamilton deposits and at Koroit beach. Wakefield (1974) accounts for the presence of these species by association with changes in the climate. Wet-forest species such as the Swamp wallaby were prominent in Lower Glenelg deposits in Pleistocene sediments *c.* 15,000 years BP and again in the late Holocene epoch. Semi-desert

forms such as the Red Kangaroo, Boodie and Bridled wallaby appear in the early Holocene epoch *c.* 8,000 years BP, and more recently (2000 — 3000 years BP) in Koroit beach aboriginal middens (LCC report). Did some or all of these species also occur in the Grampians?

The Swamp Wallaby was present in the Lower Glenelg area at least into the early 1900's, according to recollections of an early Portland farming family (A.C. Beauglehole, pers. comm.). The present most western occurrence given by Wakefield (1974) is the Otways, extending to the Port Campbell National Park. There is no evidence that it still occurs in the Lower Glenelg National Park (A. Arnold, National Parks Service, pers. comm.).

The presence of the Swamp Wallaby in the Grampians was established in March 1979. Mr Don Macarthur, a farmer whose property at Mirranatwa adjoins State Forest in the Serra Range, captured a small wallaby amidst tussocks. The distinctive grey, black and reddish brown pelage signified to Mr Macarthur that this was not the common red-necked wallaby. He gave the animal to Mrs Susan McInnes of Victoria Valley but, despite treatment, it soon died. Subsequently the wallaby came into my possession and I lodged the specimen with the National Museum of Victoria. Confirmation of identity was obtained from the curator of mammals, Miss Joan Dixon. Other individuals of the species have subsequently been seen in the Mirranatwa Gap area on both east and west slopes of the Serra range. The extent of distribution of the species in the Grampians is unknown although there appear to be similar habitat areas (thickets of tea-tree, melaleuca and heath) elsewhere on lower slopes of the ranges.

Wakefield (1974) considered that of the sub-fossil species, only the Bettong was present in western Victoria at the time of European settlement. The Rufous rat kangaroo was regarded in the LCC report as having been present. Perhaps, in the light of the discovery of the Swamp Wallaby in the Grampians, one should not rule out the possibility of the survival of one of these smaller species too.

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A Short History of the Discovery and Naming of Banksias in Eastern Australia

Part I Banks & Solander

BY A.I. SALKIN*

It is now nearly 300 years since Europeans first collected plants in Australia. During that long period, collectors from practically all European countries collected and named material and stored it in public and private herbariums. One of the problems created for Australian taxonomists was the diversity of the botanists who named plants and the location of material used as type specimens. This series of articles attempts to give some sort of perspective to this problem. It does this by looking at one genus *Banksia* and traces the slow collection of species in eastern Australia and tries to make some sense of what is still a confused picture.

The landing of Captain James Cook on the eastern seaboard of New Holland marks what most observers regard as the beginning of scientific botany in Australia. It also marks the beginning of study into an unusual and attractive genus in the family Proteaceae, the genus *Banksia*.

Cook and in particular the "scientific gentlemen" Banks and Solander were, however, not the first men to make scientific collections in Australia; seventy-one years earlier in 1699 William Dampier had made two small but important collections in the vicinity of Shark Bay (Mueller, 1883; Osborne & Gardner, 1939; George, 1971) and a Dutch navigator possibly Willem de Vlaming (Brown, 1814) had collected in the region of the Swan River in 1697, two years before Dampier.

Whilst no *Banksia* species are known to have been collected on these early visits, the occasions are worth recalling because they epitomise aspects of early botanical collections that create problems for later botanists. In the case of Dampier the collection as far as we know was not described even though it was the first known authentic collection, and as the localities and dates of collection are not given it is difficult even to speculate at which of his landing points the collections were made.

The second known collection has even more problems associated with it than the first. In the herbarium of the Geneva Botanic Gardens are two specimens that could only have come from Western Australia. They bear the locality Java and were described by the Dutch botanist Burmann in 1768 as ferns but are the leaves and stems of *Acacia truncata* (Burm.f.) Hort. ex Hoffmsg, and *Synaphea petiolaris* (Burm.f.) Merrill. Robert Brown in his report on the botany of New Holland, (Brown, 1814) was aware of this discrepancy and commented:

"The genus *Synaphea* seems to be confined to the south west coast of New Holland for it is more likely that *Polypodium spinulosum* of Burmannus (flor. ind. 233 t 67.f.1.) which I have formerly referred to this genus as well as *Adiantum truncatum* of the same author long since determined to be a species of *Acacia* by Mr Dryander were brought from that coast to Batavia by one of the Dutch navigators, perhaps Vlaming, than that they are really natives of Java, from which Burmannus received them."

The scientific collections of Banks and Solander were of an entirely different order than the two known earlier collections; they are not only much more extensive but they also established the

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methodology for collecting, drying and labelling specimens. Whilst fault may be found with the zoological specimens (Whitehead, 1969) the meticulous order of the botanical specimens enables later work to be done with confidence. Whilst only locations are given on specimen slips, these in conjunction with the journals kept by Cook, Banks and Solander (Beaglehole, 1955, 1963; Solander, 1770), as well as the ship's log enable us to give fairly accurate locations and dates for any of the 600 species collected in Australia, and more important, it allows us to correct species determination if a species is known not to grow at a particular locality.

On April the 30th, 1770, Cook landed on the Australian continent for the first time at a place he first called Stingray Harbour (then Botanists Bay, and finally Botany Bay) (Wharton, 1893, Beaglehole, 1955). The scientific gentlemen collected one hundred and sixty one species of plants and there is evidence from manuscripts that they may also have collected a further eleven species. A recent vegetation survey (McKern, 1965) of the landing area lists only twelve species not collected or mentioned by Banks and Solander. Many duplicates of each species were collected. In the case of *Banksia integrifolia* for instance there are fifty five known duplicates (McGillivray personal communication). It is little wonder then that Cook remarked in his log:

"The great quantity of plants Mr Banks and Dr Solander found in this place occasioned my giving it the name of Botany Bay."

At this site, four *Banksia* species were collected. These were what we now know as *B. serrata*, (the lectotype for the genus), *B. integrifolia*, *B. ericifolia*, and *B. robur*. A further species was collected when the ship was careened in the Endeavour River after being holed on the Great Barrier Reef; this was the only tropical species, *B. dentata*. Solander in his manuscript (Solander, 1770) regarded this as the same broad leaved species collected at Botany Bay which we now know could only have been *B. robur*. The National Herbarium of Victoria has many of the duplicates of the Banks and Solander collection and among these is one labelled *B. dentata*, the collection site is given as Stingray Bay, the previous name for Botany Bay. If the collection site label is correct, the specimen cannot be *B. dentata* and can only be *B. robur*. It is somewhat difficult from the material and from its condition to distinguish it from *B. dentata* and as the phytoglyphs xx of the two species are similar, this is also no help even if material could be obtained for analysis. There is, however, the suspicion that this is the species collected at Botany Bay that Solander assumed was the same as the species collected at the Endeavour River.

The ship reached England in July 1771 and the ambitious plans for what at that time was one of the greatest scientific collections did not come to fruition. There are many reasons for this. There is the involvement of Banks in other activities but the most plausible reason is that most botanists were daunted by the magnitude of even giving names to the vast quantity of material brought back. Sir Edward James Smith in his "A Specimen of the Botany of New Holland" (1793) gives some insight of the task facing botanists of his day.

"When a botanist enters on the investigation of so remote a country as New Holland, he finds himself as it were in a new world. He can scarcely meet with any certain fixed points from whence to draw his analogies; and even those that appear most promising, are frequently in danger of misleading, instead of informing him. Whole tribes of plants, which at first sight seem familiar to his acquaintance as occupying links in Nature's chain, on which he has been accustomed to depend prove on nearer examination, total stranger, with other configurations, economy, and qualities.

Not only are all the species that present themselves new, but most of the genera, and even natural orders."

The collection came to be known as Banks cabinet, (Stafleau, 1966) and was added to by collectors whom Banks employed. It was on Cook's third and fatal voyage of exploration that a further *Banksia* species was added to the collection. This was collected by David Nelson at Adventure Bay, South Bruny Island, Tasmania in 1776 and is the species we now know as *B. marginata.*

It was not until 1781 that any of the six *Banksia* spp. so far collected were described and then only four of the six in Banks' herbarium were described. The description was published in a supplement to Linnaeus's "Genera Plantarum" in 1781, not by Linnaeus who had died in 1778, but by his son Carl von Linne. The Spanish botanist Antonia Jose Cavanilles in the "Anales de Historia Natural", (Cavanilles, 1800) relates how initially the German botanist Forster, who was Banks' collector on Cook's second voyage, named a number of species from New Zealand, *Banksia,* after Banks. Carl von Linne thought these were not a new genera but members of the genus *Passerina.* He therefore used the name *Banksia* for the four species from Australia. The species from New Zealand were however members of a new genus and their rediscoverer, Gaertner, in order to avoid confusion, named them *Pimelia.*

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xx phytoglyphs are preparations made from leaf cuticle and are often specific for a Linnean species and sometimes even show variation at the sub species level.

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Mammals and Birds in Part of the Cobaw State Forest, Victoria

By M.W. Boyce*, K.A. Boundy* and D.D. Hanson*

Study area

The Cobaw State Forest (See Figure 1) is 2,440 ha of open forest II (*sensu* Specht 1970) situated in the Cobaw Range which forms part of the huge granitic outcrop known as the Cobaw batholith extending from Kyneton to Pyalong. Soil is friable red gradational.

The study area, approximately 13 km from Lancefield and at an altitude of 675 m, comprises 2.5 ha in the northern section of the Forest. The area was last burned by the Forests Commission in 1970. Much of the area is littered with fallen trees, a legacy of logging and storm damage. Granite boulders and outcrops are scattered throughout the area and these, together with the fallen trees, provide potential cover for small ground dwelling mammals. Average annual rainfall is 750 mm. The area was chosen as it represents the vegetation type of the Forest.

The canopy is comprised of Messmate (*Eucalyptus obliqua*) and Manna Gum (*E. viminalis*). Selective felling of mature trees occurred up to 1972. The burned out remains of some large Messmates exist, two of which have a circumference of 8 m at breast height indicating that the area once had some very large trees, although now the oldest trees are mainly 15 m high.

The understorey is sparse consisting almost entirely of Silver Wattle (*Acacia dealbata*), the majority of which are thin and straggly with only a small number reaching a height of 2.5 m.

The ground layer ranges from sparse to areas where there is a dense mixture of grasses and sedges or dense patches of

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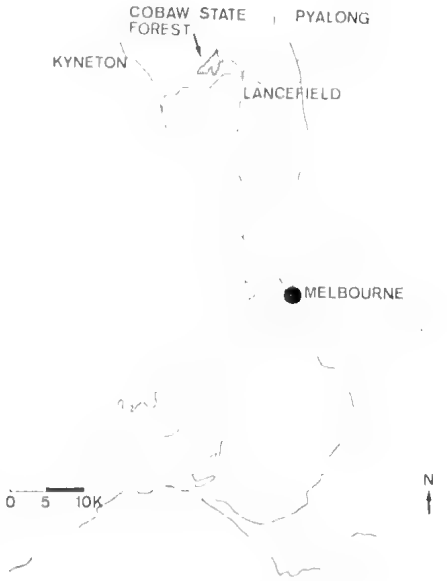

Fig. 1. Location of Cobaw State Forest

Austral Bracken (*Pteridium esculentum*). Common species among the ground layer include Greenhood orchids (*Pterostylis spp*), Pink fingers (*Calendenia carnea*), Common bird-orchid (*Chiloglottis gunni*), Clematis (*Clematis aristata*), Bidgee-widgee (*Acaena anserinifolia*), Ivy flat-pea (*Platylobium triangulare*), Cut-leaf cranesbill (*Geranium solanderi*), Ivy-leaf violet (*Viola hederacea*), Purple violet (*V. betonicifolia*), Prickly woodruff (*Asperula scoparia*), and Austral bears-ear (*Cymbanotus preissianus*).

Methods

Field work took place during a six week period of October and November 1980.

Trapping, spotlighting, observation by day and interpretation of skeletal materials, tracks, scratchings and faeces were the methods by which animal presence was noted. However, only species actually captured or positively sighted are included in the results section.

One hundred trap sites were established on a 500 x 500 m grid using a 50 m grid interval. Trapping took place on three consecutive nights for each of three consecutive weeks (900 trap nights). Wire cage traps (36cm x 20cm x 16cm), baited with a mixture of honey, rolled oats and peanut butter, were set out each afternoon and checked early the next morning.

Spotlighting was undertaken between dusk and 2230 hours using a 12 volt sealed beam spotlight and battery. Mammals sighted were recorded together with location and, in the case of arboreal animals, the species of tree in which they were observed. Although it was not possible to cover the whole area by spotlighting, enough residual timber tracks and animal pads existed to allow a significant proportion of the area to be surveyed. Rain and heavy winds limited spotlighting to five hours.

Whilst working in the study area birds were observed with the aid of Pentax 8 x 40 binoculars. Calls were used to determine presence of some species but only those actually sighted in, or flying above, the study area were recorded.

Results

Ten species of mammals were recorded and are listed in Table 1. Table 2 lists the birds observed with those most commonly recorded asterisked. Bats were seen by spotlight but none were captured or positively identified.

Discussion

The diversity of the mammal community found was low but might have been higher if the area had been sampled over a longer period of time. Other species that have been recorded in the Forest are the Feathertail Glider (*Acrobates pygmaeus*) and the Tuan (*Phascogale tapoatafa*), (Mammal Survey Group of Victoria, *pers. comm.*). Scratchings and faecal evidence strongly suggest the presence of Echidna (*Tachyglossus aculeatus*) or Bandicoots.

There was little blossom available for birds during the period of the survey. However, there was an abundance of insect life which probably explains why most birds observed were insectivorous.

TABLE 1
Mammals recorded in the study area

Species	Number Recorded	Rate per * 100 trap nights 100 spotlight hours
A. Trapped		
Trichosurus vulpecula	4	0.4
Pseudocheirus perigrinus	1	0.1
Antechinus stuartii	48	5.3
Rattus rattus	9	1.0
Felis catus	1	0.1
B. Spotlighted		
Macropus giganteus	1	20
Pseudocheirus perigrinus	1	20
Petaurus breviceps	2	40
Phascolarctos cinereus	1	20
C. Sighted		
Macropus giganteus	4	
Wallabia bicolor	3	
Phascolarctos cinereus	2	
Oryctolagus cuniculus	1	

* 900 Trap Nights
5 Spotlight Hours

TABLE 2
List of birds seen in the study area

Brown goshawk	*Accipiter fasciatus* (Vig. and Horsf.)
Wedge-tailed eagle	*Aquila audax* (Latham)
Sulpher-crested cockatoo	*Cacatua galerita* (Latham)
Crimson rosella	*Platycereus elegans* (Gmelin)
Golden bronze cuckoo	*Chrysococcyx lucidus* (Gmelin)
Boobook owl	*Nivox novae-seelandiae* (Gmelin)
Kookaburra	*Dacelo gigas* (Boddaert)
Sacred kingfisher	*Halcyon sancta* (Vig. and Horsf.)
Superb blue wren	*Malurus cyaneus* (Latham)

White-browed scrub wren
Sericornis frontalis (Vig. and Horsf.)
Brown thornbill* *Acanthiza pusilla* (White)
Yellow-tailed thornbill
Acanthiza chrysorrhoa (Quoy and Gaim)
Grey fantail* *Rhipidura fuliginosa* (Sparrman)
Eastern yellow robin* *Eopsaltria australis* (White)
Scarlet robin* *Petroica multicolor* (Gmelin)
Rufous whistler *Pachycephala rufiventris* (Latham)
Golden whistler* *Pachycephala pectoralis* (Latham)
Grey shrike-thrush*
Colluricincla harmonica (Latham)
White-throated treecreeper*
Climacteris leucophaea (Latham)
Red-browed treecreeper
Climacteris erythrops (Gould)
Spotted pardalote*
Pardalotus punctatus (Shaw and Nodder)
Yellow-faced honeyeater
Meliphaga chrysops (Latham)
White-eared honeyeater
Meliphaga leucotis (Latham)
White-throated honeyeater
Melithreptus albogularis (Gould)
White-naped honeyeater*
Melithreptus lunatus (Vieillot)
Australian magpie
Gymnorhina tibicen hypoleuca (Latham)
Grey currawong *Strepera versicolor* (Latham)
Australian raven
Corous coronoides (Vig. and Horsf.)
Little raven
Corous mellori (Mathews)

Acknowledgements

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Protected species of mammals were handled under the provision of a permit issued by the Fisheries and Wildlife Division, Ministry for Conservation.

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A Note to Prospective Authors

Contributions to *The Victorian Naturalist* are sought which deal with any aspect of natural history, field biology or earth science, but which preferably have a Victorian emphasis. Intending authors are requested to forward two copies of their manuscript, if possible typed and double spaced, to the editor. Acceptance is subject to approval by the referees and editor. Authors will receive galley proofs for checking; these should be returned promptly to ensure there are no delays in publication. Diagrams (in black ink on white card) and photographs (black and white) may also be included and the details should be of sufficient size and clarity to enable suitable reduction. Authors will receive 25 reprints *gratis*. If more are required, then orders should be made directly with the printer when proofs are forwarded for correction.

Authors are also requested to forward nature notes describing interesting observations, experiences or results of experiments which might not warrant inclusion in the journal as a full scientific paper because of their nature or size. Notes are usually refereed, but free reprints are not supplied. Reviews of books may also be sent to the editor.

Another form of contribution sought from authors is that of the general or review natural history article. Unlike scientific articles, these need not present data from "new" observations or experiments; rather, such general articles could review current knowledge, discuss the historical bases or highlight some significant aspects of our natural history.

Style of all contributions should follow that in current issues.

N.T. Burbidge Memorial Lecture

The Burbidge Memorial Lecture was instituted by the Australian Systematic Botany Association in honour of Nancy Tyson Burbidge, for many years curator Herbarium Australiense and at the time of her death Director Flora of Australia project. Throughout her long and distinguished career she promoted an interest in Natural History and published non-technical books on eucalypts, wattles and grasses. Amongst her technical writings was a note on *Ixodia* published in the *Victorian Naturalist* (75: 95-6, 1958).

The following address was the second to be delivered and was presented at a meeting of the Australian Systematic Botany Association held in conjunction with ANZAAS in May 1980.

Seedlings and the Australian Flora

BY H.T. CLIFFORD*

It is a high honour to be invited to deliver this memorial address and it is with a sense of humility that I do so for we have met to honour the memory of a distinguished and versatile colleague. Nancy Burbidge was a botanist in the widest sense and published important papers in plant ecology, geography and taxonomy. In addition, she produced several basic bibliographic treatises and wrote or contributed to a number of expository floras and handbooks.

This evening's address is concerned with seedlings. For those of you who may think them dull I can only say that I share the opinion of Topp (1890) who claimed in his Presidential address to the Victorian Naturalists, they were "a most interesting and suggestive subject". In discussing the seedlings of Australian plants I believe I am touching upon a relatively neglected area of study, though one with a long history. However, since seedlings can usually be studied with relatively little equipment or funds they may well prove to be more popular in the immediate future than in the past. The discussion will be restricted to the seedlings of dicotyledons largely because they display a bewildering array of diversity as compared with those of the monocotyledons.

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St Lucia, Qld. 4067

The raising of seedlings can be a pleasurable occupation but is at times frustrating for so many species require somewhat specialized conditions to germinate successfully. In addition there are innumerable hazards to which the seeds and seedlings may fall victim. These have been admirably summarized as follows, with reference to seedling Eucalypts.

"One reason why these records are incomplete is that during a generation seedlings have disappeared at various stages through accident, climatic changes, attacks by insects and animals, and the various happenings of a nursery" (Maiden, 1933).

A problem I failed to anticipate was that of seedlings being crushed by canetoads squatting in pots!

Of the many aspects of plant science to which a knowledge of seedlings may contribute, only five will be considered. The choice is quite idiosyncratic and reflects my own interests in the subject over the past 30 or so years.

Where references are cited they are generally the oldest of which I am aware

in order to stress the works of earlier botanists in this, a Memorial Lecture.

(a) Taxonomy

One of the earliest applications of seedling data to the classification of Australian plants was apparently due to De Candolle (1828) who divided the genus *Eucalyptus* into two sections on the basis of their possession or otherwise of alternate leaves. In reaching this decision he was probably influenced by the descriptions of new species which at that time were often based upon immature specimens grown in pots (Maiden, 1902).

Though in this instance the role of seedling characters may have been misinterpreted their value in contributing to the taxonomy of *Eucalyptus* was later re-affirmed by Mueller who in his account of *E. cornuta* in the Eucalyptographica wrote, "The study of Eucalypts in their earliest stages of growth for aiding in their specific discrimination is important, as shown in the text and lithograms of several species in the present work", (Mueller, 1883).

In a like vein Bailey supported the raising of seedlings for the elucidation of relationships amongst taxonomically difficult groups. Thus in discussing *Smilax australis* R.Br. he said, "There are doubtless several forms or species amongst the specimens generally regarded as *S. australis* R.Br., but these cannot be described until they are brought under cultivation and the plants studied at all stages of their development", (Bailey, 1902).

Yet another plea for the incorporation of seedling data into taxonomic studies is found in a revision of some *Angophora* species where it is stated, "An investigation of the seedlings, not merely increases our knowledge of plants, but it puts in our hands frequently a means of differentiating species and varieties that is likely to be of very great value. This is affected both by the information gained from the form of cotyledon leaves, and also that of the primary or juvenile leaves, which so frequently differ from those of the mature plant" (Hall, 1913).

Notwithstanding the usefulness of their advice these earlier writers have been largely ignored and relatively few modern taxonomic revisions make any reference to seedlings.

The taxonomic significance of the seedling derives principally from its morphology and all its parts contribute information. Readily observable characters are the numbers, size and shape of the cotyledons as well as the form of the earliest leaves. With respect to the cotyledon number it was early reported that the seedlings of *Nuytsia* possessed several cotyledons (Drummond, 1839) and it is probable that Brown (1810) even earlier observed a plurality of cotyledons in *Persoonia* seedlings. Later records of genera with mainly polycotyledonous seedlings include *Pittosporum* (Galbraith, 1947) and *Idiospermum* (Blake, 1972).

Whilst tricotyledonous individuals occur infrequently amongst the seedlings of most species of dicotyledons they occur with relatively high frequencies amongst the progeny of *Melaleuca quinquenervia* (3-4%) and *Aegiceras corniculatus* (5-10%).

Amongst the dicotyledons cotyledon shape and size is quite diverse. In some families such as the Bignoniaceae the cotyledons of the different species are remarkably similar, in other families including the Proteaceae the cotyledons of the different species assume a wide range of shapes and sizes. The taxonomic significance of the cotyledons varies from group to group but clearly cannot be ignored.

(b) Genetics

Segregation amongst the seedlings raised from individual plants is often accepted as an indication that they are of hybrid origin. The segregation may be extensive as has often been shown for

suspected *Eucalyptus* hybrids (McAulay, 1938; Brett, 1938), or it may involve the production of only two seedling types.

An example of the latter situation was reported by Hall (1910) for the genus *Acacia*. Here seed was collected from a cultivated tree of *A. baileyana* which was growing near to *A. decurrens*. Both trees had been in flower at the same season. On raising seedlings it was found that about 20% were hybrids, as judged from their morphology, the remainder resembling those of the seed parent.

In a like manner the progeny of wild plants of *Banksia oblongifolia* growing in south-east Queensland are often of two kinds. In some years, up to 6% of the seedlings raised differ from those typical of the species and grow into plants intermediate in morphology between *B. oblongifolia* and *B. robur*. Such intermediate morphology suggests the aberrant plants are F1 hybrids and their frequencies provide an estimate of the amount of pollen transfer between the parent species.

In contrast to segregation amongst siblings extreme uniformity of seedlings from a single plant is suggestive of apomictic reproduction. Another indication of apomixis is the occurrence of polyembryony, a phenomenon which is readily detected when the number of seedlings to emerge is in excess of the number of seeds sown. Apomixis is widespread in the Australian flora and polyembryony has been reported to occur in several genera including *Cassia* (Symon, 1956) and *Casuarina* (Barlow, 1958).

(c) Morphology

The evolutionary and hence taxonomic significance of the morphology of juvenile foliage as a reflector of phylogenetic relationships is widely accepted. In support of this viewpoint the seedlings of phyllode bearing *Acacia* spp. are generally, cited for their initial leaves are pinnate or bipinnate. Similarly the entire-leaved species of *Dodonaea* have seedlings with deeply dissected leaves such as are commonly encountered amongst members of the Sapindaceae.

As both *Acacia* and *Dodonaea* are widely distributed genera with many species growing in dry to semi-arid environments their joint possession of a seedling type whose first leaves are dissected and later leaves are entire is an interesting example of evolutionary convergence.

The widespread occurrence of heteroblasty in the Australian flora suggests the subject is of ecological and taxonomic significance. This viewpoint was appreciated by Diels (1906) who drew heavily on Australian examples to illustrate his book on juvenility and floral maturity in the plant kingdom.

Furthermore, the experimental morphologists have long used phyllodineous *Acacia* spp. to investigate the influence of the environment on the transition from normal leaves to phyllodes. Thus Goebel (1905) wrote "It is easy to see the formation of phyllodes is no longer under the direct influence of outer conditions for the seedling plants of *Acacia* which I examined formed phyllodes even though they were cultivated in a very moist chamber." As this quote is from an English edition of an earlier published German text the experiments must have taken place before the turn of the century.

(d) Germination

Amongst the dicotyledons there are two basic types of seedling development. With one, the cotyledons remain within (cryptocotylar) and with the other the cotyledons are withdrawn (phanerocotylar) from the testa. As a rule cryptocotylous seedlings exhibit hypogeal germination and phanerocotylous seedlings epigeal but there are exceptions in that some species e.g. *Alyxia ruscifolia* have seedlings in

which the cotyledons are raised above the ground and are hence epigeal but none-the-less remain enclosed in the testa and so are cryptocotylar.

It is generally agreed that epigeal (mostly phanerocotylar) germination is primitive in dicotyledons (Eames, 1961) and that the hypogeal (mostly cryptocotylar) condition is advanced. The basis of this opinion is rarely argued and presumably rests on the widespread occurrence of phanerocotyly amongst dicotyledons. Examination of a sample of several hundred species belonging about two hundred Australian genera has shown that germination behaviour is far from randomly distributed within the docotyledons.

If the genera are grouped into the superorders of Dahlgren (1975) only 12 of the 22 for which data are available have cryptocotylar seedlings. Amongst these the condition is relatively common only in the Magnolianae, Nymphaeanae, Theanae and Hamamelidanae taxa. And so, on the basis of its taxonomic distribution cryptocotyly would appear to be a primitive rather than an advanced trait in dicotyledons.

In addition to its phylogenetic significance the mode of germination may also be of taxonomic importance. For example, in the genus *Drosera* both phanerocotylar and cryptocotylar species occur. From the few Australian species studied it would appear the two sections of the genus are characterized by different germination patterns. Members of the sect. Rorella *(D. binata)* have phanerocotylar and members of the sect. Ergaleium *(D. peltata* and *D. auriculata)* have cryptocotylar germination (Vickery, 1933).

(e) Ecology

For the ecologist, seedlings are often a source of embarrassment in that though they are often present in study areas their identities are usually unknown. With current ecological interests turning more and more to vegetation dynamics it is probable that special keys to seedlings will be required. Fortunately, there are a multitude of characters available and such keys are not difficult to construct.

The ecological significance of the cotyledons was appreciated long ago for *Acacia* seedlings by Cambage (1915) who noted, "The cotyledons of *A. stenophylla, Bidwilli and Farnesiana* are fairly fleshy while those of *A. pendula* and *A. aneura* are slightly less so. The significance of the geographical distribution of the fleshy cotyledons will be discussed in a later paper after more evidence becomes available, but this form appears to be one which is able to exist in areas where the climate is subarid, or where the rainfall is confined mainly to one season of the year." Unfortunately, the promised paper was apparently never published.

As distinct from its morphological importance, germination pattern is also of ecological significance as has been shown by Jackson (1974) in his study of regeneration in African savannahs. He postulated that cryptogeal (plumule carried below ground by elongating petioles of cotyledons) germination was an adaptation to fire. About Brisbane no cryptogeal species have been encountered but dicotyledonous species with cryptocotylar germination occur in much greater proportion in rainforest than in *Eucalyptus*-forest communities so protection of the plumule is in this instance not against fire.

The selection force favouring cryptocotylar germination in rainforests is apparently grazing and for all species tested with cryptocotylar germination the experimental removal of the primary axis has lead to the production of new shoots from the axillary buds of the cotyledons.

In view of the correlation between the taxonomic position of species and their germination patterns it is probable that species with cryptocotylar or cryptogeal

germination are pre-adapted to the savannah environment in that they were derived from taxa already possessing that character. As yet no example of species with cryptogeal germination appears to have been recorded for Australia.

It is appropriate in concluding these remarks on the ecological importance of seedlings to draw attention to two papers by Nancy on the germination of Australian Chenopodiaceae (Burbidge 1945, 1946). In these works she made it clear that a knowledge of seedling behaviour in the field is a prerequisite to an understanding of the regeneration of plant communities.

From the foregoing it is clear that the seedlings of Australian Magnoliatae have contributed much to our knowledge of several aspects of botany and that they are indeed, "an interesting and suggestive subject". The long record of publications on Australian seedlings and their diversity bring them I believe within the range of interests of Nancy Tyson Burbidge who not only had a deep appreciation of plants but also of history.

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An Extra Plant Record for Tasmania

BY JOHN S. WHINRAY*

Some plants that occur on the Australian mainland are found in Tasmania only on Bass Strait islands (Curtis, 1956; 1963; 1967). On some eastern Tasmanian Bass Strait islands I have found previously thirteen more plants which, in the Australian region, were not known to occur south of Victoria (Whinray, 1973).

This note records the extension of the range of the bogrush *Schoenus carsei* Cheesem. to Cape Barren and Clarkes Islands in south-eastern Bass Strait. The species was thought to be confined to South Australia, Victoria and New Zealand (Black, 1960; Eichler, 1965; Willis, 1973), until my specimens were determined.

Cape Barren, of about 44 000 hectacres in area, is the second largest island of the Furneaux Group and Clarkes, of about 9 000 hectares, is its third largest island.

Cape Barren Island Records.

My first record of *Schoenus carsei* was made at Prickly Bottom Flat in the north-west of the island on 9 January 1970 (MEL, HO).** Next I collected it by the north coast on Chimney Hill Flat near Victualling Office Bay on 8 June 1970 (MEL).

Since then I have obtained specimens from one more Prickly Bottom Flat locality (MEL, AD, CANB), and from two localities at Kents Bay in the south-eastern part of the island (MEL, AD, CANB). I have also recorded it at five other Prickly Bottom Flat sites and in six more places in the south-eastern part of the island. Two of the latter records were made at Kents Bay.

Schoenus carsei occurs in permanently damp or wet places such as springs, bogs, stream margins, bottoms and peaty flats. The associated plant species vary from place to place. Two very different sites will now be described briefly.

One very wet Prickly Bottom Flat site was the edge of Bull Scrub Creek, about one kilometre south-east of its mouth. At this spot the shrubs were short, having regrown since a fire of about four years before (c. 1972). They were Manuka *Leptospermum scoparium*, Bushpea *Pultenaea dentata*, Slender Honey-myrtle *Melaleuca gibbosa*, Swamp paperbark *Melaleuca ericifolia*, Scented Paperbark *M. squarrosa*, and Bluntleaf Heath *Epacris obtusifolia*.

The six rushes growing in this association included Sea Rush *Juncus krausii*, *Schoenus carsei*, and Slender Twigrush *Baumea gunnii*. The other herbs included Angled Lobelia *Lobelia alata*, Mossy Pennywort *Hydrocotyle muscosa*, and Tufted Centrolepis *Centrolepis fascicularis*.

The driest site on Prickly Bottom Flat was a small bottom on its western side, about one kilometre south-south-west of the mouth of Hammonds Creek. The dominant species there was Pithy Swordsedge *Lepidosperma longitudinale* growing to one metre high. Associated with it were a few clumps of Coast Sawsedge *Gahnia trifida* to 1.2 metres high.

As the area had been fired about three years previously (c. 1973), all the shrubs were lower than the swordsedge. They were Manuka *Leptospermum scoparium*, Slender Honey-myrtle *Melaleuca gibbosa*, Heath Honey-myrtle *M. squamea*, Bushpea *Pultenaea dentata*, Dagger Hakea *Hakea teretifolia* and a Guineaflower *Hibbertia* sp.

Some of the herbs of this site were Everlasting *Helichrysum dealbatum*, the

*Flinders Island, Tasmania, 7255.

**Specimens lodged in Australian herbaria are indicated by the standard abbreviations for those institutions.

exotic White Cudweed *Gnaphalium candidissimum*, Spreading Roperush *Calorophus laterifolius*, and *Schoenus carsei*.

Clarkes Island Record.

The one occurrence of *Schoenus carsei* on this island was found on 25 September 1976 in a small depression about 300 metres south-west of the southernmost part of Sandy Lagoon. The site is at the southern edge of the many old consolidated dunes of the Sandy Lagoon area and receives seepage from them. The vegetation was fired in about December 1974.

The lowest part of the depression contained shallow water and had a dominant layer of much Pithy Swordsedge *Lepidosperma longitudinale* and occasional clumps of Coast Sawsedge *Gahnia trifida*.

Lower herbs grew between the northern edge of the tall sedges and the bank. The species included *Schoenus carsei*, Longleaf Wallabygrass *Danthonia longifolia*, which is rare in Tasmania (CANB), and Centella *Centella cordifolia*.

Schoenus carsei was collected just above the water level on the damp northern bank of the depression (MEL, CANB). The low shrubs with it were Pink Swampheath *Sprengelia incarnata*, Slender Honey-myrtle *Melaleuca gibbosa*, Scented Paperbark *Melaleuca squarrosa* and Swamp Boronia *Boronia parviflora*. The herbs there were Pale Twigrush *Baumea acuta*, Everlasting *Helichrysm dealbatum* and Grassy Rush *Juncus caespiticius*.

Comment

Most of the central and eastern Cape Barren Island has been recommended as a potential Wilderness Reserve (Whinray, 1977; Russell, *et al.*, 1979). This extra record for Tasmania increases the number of unusual plants known to occur in the potential reserve and adds to its interest.

Acknowledgements

Miss M.H. Christie provided considerable assistance with many Cape Barren Island trips. Mr G.W.G. Goode generously lent his boat on several occasions. Dr J.P. Jessop, of the State Herbarium, Adelaide, first determined one of my collections as *Schoenus carsei*. Dr J.H. Willis soon afterwards determined further material. Mr R.B. Filson made helpful comments on two late drafts of this note.

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New Book

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Book Review

Life on the Rocky Shores of S.E. Australia — an illustrated field guide.

By G.C. Wescott, R.N. Synnot and H.K. Powell

Available from "Rocky Shores", P.O. Box 154, Yarraville, Victoria, 3013. Price. $2.00 (plus 50¢ postage).

This small book is intended as an inexpensive introduction to the life of the rocky shore for the untrained person. Its 84 pages cover over 70 species of the commonest plants and animals found on Victorian rock platforms, giving a brief description and notes on range, habitat and ecological relationships. Each species is illustrated either by a drawing or a photograph and the authors have confined themselves to the commonest, most readily encountered organisms.

It is a pity that this book apparently had to be produced on a shoe-string. A reduction technique for this type, some professional help with design and more time and care taken with the illustrations could have resulted in a far deeper coverage for the same sized publication and a much more professional looking production. Yet despite these considerable shortcomings the contents are basically sound and as a first introduction for the beginner in sea shore observation the book is well worth the very low purchase price.

Brian J. Smith

'Tasmanian Echinoderms' By Alan Dartnall

('Fauna of Tasmania' handbook no.3, University of Tasmania, June 1980. 21 x 14.5 cm., 84 pp., stapled, soft cover. Available from 'Fauna of Tasmania' Office, University of Tasmania, Box 252C, G.P.O., Hobart, Tasmania, Australia. 7001. Price $3.75 (including postage and packing). Cheques and money orders to be made payable to the 'University of Tasmania'.)

In the absence of any book devoted to the echinoderm fauna of south-eastern Australia this handbook is a welcome arrival. The University of Tasmania has commenced the production of a series of handbooks and posters on the 'Fauna of Tasmania' with a view to collating the information now available and to stimulate interest in the Tasmanian fauna and flora. The intention of the Committee is to devote each handbook to a defined taxon, and to include a checklist, illustrated keys for identification, distribution maps, a description of basic morphology, and an explanation of methods of collecting and preserving and examining specimens.

Thanks to Alan Dartnall this has now been accomplished for the echinoderm fauna. Alan has worked on the taxonomy and biology of these animals for ten years, and wrote this handbook while he was working in the Zoology Department of the University of Tasmania.

Half of the handbook is devoted to keys, which are not intended to have phylogenetic or extra-Tasmanian value. However, all but very few of the Victorian shallow water echinoderms are in the Tasmanian checklist and keys. Unfortunately, there are too few of the very good line diagrams in the keys, and there is no glossary for the

handbook. I suspect that the keys will pose problems for the uninitiated.

The only photographs which are reproduced in the booklet are the few which are included to illustrate 'body form'. They give no indication of the size of the respective animals, and they lack important taxonomic detail. However, they are useful for confirming identity in association with the keys and it is disappointing that so few are included.

A quarter of the handbook is made up of a series of distribution maps for all of the species. Coded information on depth range and substrate is included with the maps. This is a most useful presentation of current knowledge about Tasmanian echinoderms, and is an obvious stimulus and guide for field-workers. This aspect of the booklet is naturally of limited value for those interested only in Victorian marine fauna.

The section of the handbook on collection, preservation, and examination of specimens is disappointing. There is no indication of suitable concentrations for the narcotising agents. There is no indication of how the neutral formaldehyde solution for fixing can be made up. The suggestion that a low power dissecting microscope is suitable for examining the spicules of holothurians is quite misleading.

A bibliography is included with the intention of complementing the major work on Australian echinoderms by H. L. Clark and introducing the reader to recent work.

This handbook does bring together for the first time a great amount of information on the echinoderms of south-eastern Australia. Much of the information is relevant to the Victorian fauna, and the booklet is recommended for those who are professionally interested in the Victorian marine fauna.

Mark O'Loughlin

The Origin of Generic Names of the Victorian Flora

Part 3 — Latin, Greek and Miscellaneous

(Continued from page 225, Vol. 97, No. 5.)

By James A. Baines

***Verbascum.** The Lat. name for mullein, used by Pliny. Gaius Plinius Secundus, known in English as Pliny the Elder (born 23 A.D., died in the eruption of Vesuvius that destroyed Pompeii and Herculaneum in 79 A.D.), wrote 'Historia Naturalis' in 37 books, reprinted in Latin with English translation in 10 volumes in Loeb Classical Library — a fascinating mixture of science and superstition. The word mullein comes from Fr moulaine (probably from mol, soft), though Skeat suggests an Anglo-Saxon origin. Our species include **V. thapsus*, Great Mullein, Blanket Weed, Flannel Leaf or Aaron's Rod, and the other 2 species are also known as kinds of mullein. The genus is in family Scrophulariaceae. Thapsus is a superseded generic synonym of Aaron's Rod (from Isle of Thapsos, thapsinos, yellow).

Verbena. Lat. verbenaca, name of the plant Vervain (which is an English form of verbena), from verbenae, boughs of olive, laurel, myrtle, cypress and tamarisk, carried in sacred ceremonies by the Fetiales (in Livy), and by certain priests (in Cicero). *V. officinalis*, Vervain, was given the specific epithet because it was used in herbal remedies in Europe, but it is also native here. Our other 3 species are introduced, known as different kinds of verbena, although **V. bonariensis* (— 'from Buenos Aires'), Purple-top or Cluster-flower Verbena, is often called Squareweed, from its 4-sided stems, square in section. The genus gives its name to family Verbenaceae.

Omission Vol. 98 (1)

The following text was mistakenly omitted from the article "Introduced Mammals in Victoria" by H. Brunner, P. L. Stevens and J. R. Backholer which appeared in the last issue of *The Victorian Naturalist*. It is to be inserted on page 12, after line 33 ("some $300,000 on dog control").

Environmental aspects

The disappearance of the Tasmanian tiger has left dingoes and feral dogs as the only large mammalian predators in Australia. Presumably their numbers are mainly determined by the availability of food and space. More factual information is needed on the effect these predators may have had in the past on our wildlife and what effect they are having at the present time.

Results of recent studies carried out in many parts of Australia suggest that well established native prey species are not endangered because of these predators. This is particularly true for the large areas of forest and desert not inhabited by man. In the cases of rare species, there is obviously reason for concern that dingoes, dogs and other predators may speed up the disappearance of these animals.

Privately owned dogs which are often allowed to roam in packs through wildlife reserves, isolated bush blocks, forest parks and fringe areas of forests are undoubtedly a great menace to wildlife species in those areas. Wallabies, kangaroos and lyrebirds are often harassed and killed in some conservation areas close to urban development. Attention, however, is mainly drawn to the bitter complaints of farmers who suffer frequent losses of livestock because of these killer dogs (M.M.B.W., Aberdeen *et al.* 1977).

Another important aspect is the concern expressed by the dingo conservationists who fear for the future of the pure dingo. They feel that this breed may eventually disappear because of continuing cross-breeding with domestic dogs. However, data for this contention are lacking.

Control

Few advances have been made in feral dog control and we are still using the traditional means of steel jaw traps and poison. Because of the elusive nature of dogs, other methods such as shooting or organized drives have generally proved unsuccessful.

In Victoria approximately twenty dogmen are employed by the Department of Crown Lands and Survey in dingo and feral dog control. Most of these operators rely heavily on steel jaw traps, but some poisoning is used. Traps are set along forest tracks near places where dogs might defaecate or urinate. These traps are usually left in the one area for many weeks and visited at regular intervals. In many cases, dog faeces are used to lure the dogs into the traps.

Unfortunately, trapping is a relatively non-specific technique and numbers of other animals (wallabies, wombats etc.) are often caught. For this reason, we are currently investigating more selective and also more humane types of traps and snares.

FIELD NATURALISTS CLUB OF VICTORIA

Report by Executive Council

The members of the Executive Council submit herewith balance sheet as at 31 December 1980 and income and expenditure account for the year ended on that date, and report as follows:-

1. The Net Surplus of the Club for the year ended 31 December 1980 was $60 which, added to the Surplus brought forward at 1 January 1980 of $10,240, together with a transfer of $833 from Club Improvement Account, resulted in an Accumulated Surplus to be carried forward to next year of $11,133.
2. The members of the Executive Council took reasonable steps to ascertain, before the income and expenditure account and balance sheet were made out, that all known bad debts were written off and adequate provision was made for doubtful debts.
3. The members of the Executive Council took reasonable steps, before the income and expenditure account and balance sheet were made out, to ascertain that the current assets, other than debtors, were shown in the accounting records of the company at a value equal to or below the value that would be expected to be realised in the ordinary course of business.
4. At the date of this report, the members of the Executive Council are not aware of any circumstances which would render the values attributable to the current assets in the accounts misleading.
5. No charge on the assets has arisen, since the end of the financial year to the date of this report, to secure the liabilities of another person. No contingent liability has arisen since the end of the financial year to the date of this report.
6. No contingent or other liability has become enforceable or is likely to become enforceable within the period of twelve months after the end of the financial year which in the opinion of the members of the Executive Council will or may affect the ability of the Club to meet its obligations as and when they fall due.
7. At the date of this report the members of the Executive Council are not aware of any circumstances not otherwise dealt with in the report or accounts which would render any amount stated in the accounts misleading.
8. The results of the Club's operations during the financial year, in the opinion of the members of the Executive Council, were not affected by any item transaction or event of a material and unusual nature.
9. Since 31 December 1980, and to the date of this report, in the opinion of the members of the Executive Council, no item transaction or event of a material and unusual nature has occurred, which would affect substantially the results of the Club's operations for the next succeeding financial year.
10. No member of the Executive Council, since the end of the previous financial year, has received or become entitled to receive a benefit by reason of a contract made by the Club with the member or with a firm of which he is a member or with a company in which he has a substantial financial interest.
11. 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.
12. The names of the members of the Executive Council in office at the date of this report are as follows:-

    Dr B. Smith
    Miss M. Allender
    Miss W. Clark
    Mr D. Dunn
    Mr M. Howes
    Mr D. Jinks
    Miss L. Lumsden
    Miss M. Lester
    Mr J. Martindale
    Mr A. Thies
    Mrs H. Weatherhead

This report is made in accordance with a resolution of the Executive Council dated 31st day of March 1981.

B. Smith President
D. Dunn Treasurer

FIELD NATURALISTS CLUB OF VICTORIA
BALANCE SHEET AT 31 DECEMBER, 1980

LIABILITIES

1979			
	Current Liabilities		
$702	Subscriptions paid in advance	$1,169	
2,110	Sundry Creditors	2,013	
132	M. A. Ingram Trust Grant in hand	12	
5,500	Treasury Grants in hand (Note 3)	6,000	
$8,444			
	Special Funds & Accounts		
$5,486	Building Fund	$6,000	
27,479	Publication Fund	31,800	
2,323	Excursion Fund	3,152	
2,000	Centenary Excursion Fund	2,000	
4,000	Marie Allender Excursion Fund	4,000	
100	Library Fund	100	
5,281	Club Improvement Account	5,404	
5,217	Estate M. Wright Legacy	5,217	
1,466	Estate C. M. Walker Legacy	1,466	
20	Estate R. S. Chisholm	20	
200	Estate I. F. Knox Legacy	200	
200	Estate Ivy Dixon	200	
204	Estate I. Hanks	204	
644	Wilfred C. Woollard Fund	680	
568	D. E. McInnes Fund	603	
276	V. H. & B. E. Miller Fund	300	
90	N. A. Wakefield Memorial Fund	90	
300	P. F. Morris Gift Account	300	
250	Cedric Ralph Gift Account	250	
64	Kinglake Project Fund	54	
882	Natural History Medallion Fund	1,543	
520	Life Membership Fund	520	
282	Microscope Project Account	311	
$57,852		$64,414	

ASSETS

1979			
	Current Assets		
$2,571	Cash at Bank	$4,663	
2,000	Commonwealth Bonds at cost	2,000	
261	Sundry Debtors	301	
	Stocks on Hand at cost —		
11	Badges	6	
$9,194 154	Microscope Project	129	
2,351	Books for Sale	1,372	
—	Tee Shirts	61	
1,911	Victorian Naturalist Subject Index	1,736	
$9,259			$10,268
	Fixed Assets at cost		
$6,948	Library Furniture & Equipment	7,780	
	Land —		
141	Cosstick Reserve, Maryborough	141	
—	Harold C. Frahm, Kinglake	—	
$7,089			$7,921
	Investment of Funds at cost		
$100	Australian Government Bonds	$100	
6,200	Australian Gov't Savings Bonds	6,200	
500	MMBW Debentures	500	
6,100	Esanda Ltd Debentures	6,800	
	National Mutual Permanent Building Society — Deposits	10,000	
10,000			
$22,900			$23,600
	Building Fund		
$3,300	Aust. Gov't Savings Bonds at cost	$3,000	
2,100	Esanda Ltd & Debentures at cost	3,000	
86	Cash at Bank	—	
$5,486			$6,000

	Surplus Account			
$9,643	Balance at 1/1/80	$10,240		$24,600
136	Transfer from Club Improvement Fund	833		
461	Surplus (Loss) for year	60		—
$10,240				
			11,133	
				2,055
				46
				239
				416
				123
				—
				$27,479
				$1,000
				—
				2,000
				2,552
				—
				(1,229)
				$4,323
$76,536			$84,741	$76,536

Publication Fund		
Aust. Gov't Savings Bonds at cost	$27,100	
National Mutual Permanent Building Society — Deposit	2,900	
Book Stocks at cost —		
Ferns of Victoria & Tasmania	1,145	
Wildflowers Wilsons Promontory	7	
Birds of the Dandenongs	198	
Sundry Debtors	225	
Cash at Bank	350	
Less Sundry Creditors	(125)	
		$31,800
Excursion Fund		
Aust Gov't Savings Bonds at cost	$1,000	
Nat'l Mutual Perm Bldg Soc — Deposit	2,000	
Aust Gov't — Centenary Excur'n Fund	2,000	
Cash at Bank	9,395	
Deposit Castlemaine Tour	340	
Less Sundry Creditors	(9,583)	
		5,152
		$84,741

1. Auditors' Remuneration of $130 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 Executive Council.
3. State Treasury Grants for 1977/78, 1978/79, 1979/80 and 1980/81 have been received, but grants totalling $6,000 had not been applied against expenditure at 31/12/1980.

FIELD NATURALISTS CLUB OF VICTORIA
GENERAL ACCOUNT
STATEMENT OF INCOME & EXPENDITURE FOR YEAR ENDED 31 DECEMBER, 1980

INCOME

1979				1979
	Subscriptions Received —			
$439	Arrears	$1,242		$9,980
10,250	Current	11,132		584
94	Supporting	88		1,261
$10,783			$12,462	—
400	Sales of "Victorian Naturalist"		357	$11,825
	Interest Received —			$1,716
$5	Library Fund	$5		—
110	Bank Account	108		$10,109
190	Commonwealth Bonds	190		
494	Bonds — M. Wright Legacy	494		
95	Bonds — C. M. Walker Legacy	95		$362
675	National Mutual Deposit	1,242		74
70	Life Membership Fund	69		1,036
94	Natural History Medallion Fund	127		628
$1,733			$2,330	40
	Profit — Victorian Naturalist			164
$542	Subject Index		$75	130
—	Profit — Tee Shirt Sales		68	158
25	Sundry Income		15	173
639	Profit on Book Sales		956	28
				120
				$2,913
				—
				—
				—
				639
				461
$14,122			$16,263	$14,122

EXPENDITURE

Victorian Naturalist —		
Printing	$11,071	
Illustrating	833	
Despatching	1,342	
Editorial	46	
	$13,292	
Less — Grants		
Ingram Trust — 1980 Grant	$1,660	
Treasury (Note 3)	1,000	
		$10,632
Working Expenses —		
Postage & Telephone	$385	
Printing & Stationery	222	
Bookkeeping & Typing	1,044	
Rent — Herbarium and Museum	670	
Rent for Storage	40	
Affiliation Fees, Subscriptions and Donations	359	
Auditors' Remuneration (Note 1)	130	
Insurance	206	
General Expenses	41	
Natural History Medallion Expenses	384	
Kinglake Expenses — Rates	120	
		$3,601
Centenary Expenses		260
Tee Shirt A/c — Loss written off		453
Nature Show — Loss		301
Club Improvement Account — Transfer of Profit on Book Sales		956
Surplus for Year		60
		$16,263

FIELD NATURALISTS CLUB OF VICTORIA
BUILDING FUND

Amount of Fund at 31 December 1979		$5,486
Interest on Investments and Bank Account		514
Amount of Fund at 31 December 1980		$6,000

PUBLICATIONS FUND

Amount of Fund at 31 December 1979		$27,479
Interest on Investments and Bank Account		2,337
Surplus (Loss) for the year from —		
Ferns of Victoria and Tasmania	$1,960	
Wild Flowers of Wilson's Promontory National Park	25	
Birds of the Dandenongs	(1)	1,984
Amount of Fund at 31 December 1980		$31,800

CLUB IMPROVEMENT ACCOUNT

Amount of Account at 31 December 1979	$5,281
Book Sales Account Profit	956
	6,237
Less —	
Purchase Library Books & Equipment transferred to Surplus Account	833
Amount of Account at 31 December 1980	$5,404

EXCURSION FUND

Amount of Fund at 31 December 1979		$4,323
Add —		
Interest received on Investment		861
		$5,184
Less —		
Loss on Tours	27	
Purchases	5	32
Amount of Fund at 31 December 1980		$5,152

Field Naturalists Club of Victoria
Statement by the Members of the Executive Council

In the opinion of the members of the Executive Council of the FIELD NATURALISTS CLUB OF VICTORIA, the accompanying Balance Sheet is drawn up so as to give a true and fair view of the state of affairs of the Club as at 31 December 1980, and the accompanying Statement of Income and Expenditure is drawn up so as to give a true and fair view of the financial results of the Club for the year ended 31 December 1980.

Signed in accordance with a resolution of the Executive Council on 31st March 1981. B. Smith President
D. Dunn Treasurer

Statement by the Principal Accounting Officer

I, Daniel E. McInnes, being the officer in charge of the preparation of the accompanying accounts of the FIELD NATURALISTS CLUB OF VICTORIA for the year ended 31 December 1980 state that, to the best of my knowledge and belief, such accounts give a true and fair view of the matters required by Section 162 of the Companies Act 1961, to be dealt with in the accounts.

Signed at Melbourne on the 31st day of March 1981. D. E. McInnes

Auditors' Report to the Members of
Field Naturalists Club of Victoria

In our opinion —

(a) The attached balance sheet and income and expenditure account are properly drawn up in accordance with the provisions of the Companies Act, 1961 of Victoria as amended and so as to give a true and fair view of:-
  (i) the state of affairs of the Club at 31 December 1980 and of the results of the Club for the year ended on that date;
  and
  (ii) the other matters required by Section 162 of that Act to be dealt with in the accounts.
(b) The accounting records and other records, and the registers required by that Act to be kept by the Club have been properly kept in accordance with the provisions of that Act.

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

Richmond
31 March 1981

Field Naturalists Club of Victoria

Reports of recent activities

General Excursion to Flinders
Sunday 1 February

A full coach and several car-loads arrived at Flinders to visit the intertidal zone to study marine life. Led by President Brian Smith, we were told about zonation and the effects of wave action and exposure on plant and animal life in the intertidal zone. And after an early lunch we followed the tide out on the rock platform.

The variety and profusion of life in rock pools is amazing; every rock turned over (and turned back again before leaving) reveals different creatures. There were gastropods like the large black elephant shell *Scutus antipodes*, the two commercial abalone shells — the Black-lip *Haliotis ruber* and the Green-lip *H. laevigata*, numbers of chitons, sea stars, sea urchins, to tube worms and a bewildering variety of encrustung sponges and bryozoa. Specimens were put into buckets, examined and explained, then returned to the sea.

Particularly interesting finds were a live Southern Brown Cowrie *Cypraea (Notocypraea) comptoni* and two specimens and of an unusual pycnogonid (sea-spider) with eggs.

Dr Smith pointed out some predatoc-prey relationships including the carnvarous gastropod *Lepsiella vinosa* feeding on the encrusting tube-worm *Galeolaria*.

The February excursion for intertidal marine life is becoming an annual event, and we thank Dr Brian Smith for another stimulating, informative and very enjoyable day.

General Meeting
Monday 9 February

The speaker was Dr Carroll, President of the Conservation Council of Victoria. Dr Carroll outlined the Council's work by reading the minutes of the last meeting showing positive planning and action on major issues. Such topics as Harold Holt Marine Park, pine plantations in north-east Victoria, Australian Newsprint Mills policy, Combined Energy Network and World Environment Day were among those dealt with.

Questions showed much interest in conservation but accurate information is necessary. Dr Carroll mentioned the heavy work-load of a limited staff, and intimated that the knowledge which exists among FNCV members would greatly help in the preparation of submissions.

(Perhaps some FNCV members may not know what the CCV is. It is *not* a government body but an association of various conservation organisations and individuals which aims to co-ordinate and to act as their mouth piece in presenting a common viewpoint to government public authorities, etc. The CCV examines proposed legislation concerning the Victorian environment and has representatives on the Land Conservation Council.)

Swifts. Flocks of some 200 swifts were observed flying low over the eastern suburbs. Large numbers were also sighted at Inverloch.

GROUP MEETINGS

All FNCV members are invited to attend any Group meetings, no extra charge.

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

First Tuesday — Mammal Survey Group

Tuesday, 7 April. Planigales. Speaker: Debbie Andrews.

Tuesday, 5 May. Marine mammals. Speaker; Martin Schulz.

Tuesday, 2 June. Identification of rodents.

Third Wednesday — Microscopy Group.

Wednesday, 15 April. History of the microscope. Speaker: J. Dawes.

Wednesday, 20 May. General illumination for the microscope. Speaker: Dr Hammond.

Wednesday, 17 June. Rotifers. Speaker: P. Genery.

Second Thursday — Botany Group.

Thursday, 9 April. Common seaweeds. Speaker: M. T. Sault.

Thursday, 14 May. Lichens. Speaker: Mr Rex Filson.

Thursday, 11 June. Philippines fungi. Speaker: Mr M. McBain.

At the Conference Room, the Museum, Melbourne, at 8.00 p.m.

Good parking — enter from Latrobe St.

First Monday — Marine biology and Entomology Group.

Monday, 4 May. Sea urchins. Speaker: Mr H. Bishop.

Monday, 1 June. Insects: some interesting life histories. Speaker: Mr P. Kelly.

GROUP EXCURSIONS

All FNCV members are invited to attend Group excursions.

Botany Group — last Saturday.

Saturday, 25 April. Mornington Peninsula — seaweeds.

Saturday, 30 May. Lichens.

Mammal Survey Group

Friday, 17 — Monday, 20 April. Easter camp. Children State Forest.

Saturday, 9 — Sunday, 10 May. Toponga River, Eildon area.

Saturday, 6 — Monday, 8 June. Queen's Birthday weekend. Mt. Worth.

Day Group — third Thursday.

Thursday, 21 May. Albert Park. Meet at 11.30 a.m. at Main Gate, South Melbourne Cricket Ground. Train to Albert Park Station, or St. Kilda Beach tram (No. 10 or 12 in Collins St) to corner Clarendon St and Albert Rd. Leader: K. Gill (836 8016).

Thursday, 18 June. National Art Gallery, St. Kilda Rd. Meet near floral clock. Queen Victoria Gardens at 11.30 a.m. (if weather suitable) or OUTSIDE Gallery at 1.30 p.m. (special group rates). Leader: B. Gillespie (578 1879).

FIELD NATURALISTS CLUB OF VICTORIA CALENDAR OF EVENTS

APRIL

Wed 1.	Geology Group: Kimberlite and the origin of Diamonds in N.W. Australia. Ian Hawkins Melb. State College.
Sun 5.	General Excursion to Organ Pipes National Park.
Mon 6.	Marine Biology & Entomology Group — Pond Life with a movie camera. Mr P. Genery.
Tue 7.	Mammal Survey Group. Planigales by Debbie Andrews.
Thur 9.	Botany Group. Common Seaweeds. Mr T. Sault.
Mon 13.	General Meeting. Otway Study Night. Keynote speakers to be arranged. Groups asked to prepare short addresses.
Wed 15.	Microscopical Group. History of the microscope. Mr J. Dawes.
EASTER	17-20. Mammal Survey Group — Chiltern State Forest.
Sat 25.	Botany Group Excursion. Mornington Peninsula — Seaweeds.

FOR FURTHER INFORMATION PLEASE PHONE THE RELEVANT NUMBER

FNCV Secretary	859 8091	Geology (Bus.)	697 6596
Gen Excursions	527 2749	Mammal Survey	874 4408
Spec Sty Trips	859 8091	Marine Bio & Ento	211 2427
Botany Groups	557 6045	Micro Group	211 2427
Day Group	578 1879		

Field Naturalists Club of Victoria

Established 1880

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 Honorable SIR HENRY WINNEKE, KCMG, KCVO, OBE, KStJ, QC.

Key Office-Bearers 1980-1981

President:
Dr. BRIAN SMITH, 8 Hunsford Avenue, North Clayton, 3168 (560 8358)
Secretary: Miss WENDY CLARK, 27 Rangeview Grove, North Balwyn, 3104 (859 8091)
Correspondence to: FNCV, National Herbarium, The Domain, South Yarra, 3141
Treasurer: Mr. D. DUNN, 3 Allfrey Street, East Brighton, 3187 (578 5753)
Subscription Secretary: F.N.C.V. C/- National Herbarium, The Domain, South Yarra, 3141
Editor: Mr. R. WALLIS, C/- State College of Victoria – Rusden, Blackburn Road, North Clayton, 3168, 544 8544.
Librarian: Mr. P. KELLY, C/- National Herbarium, The Domain, South Yarra, 3141.
Assistant Librarian: Miss M. J. LESTER, 4/210 Domain Road, South Yarra, 3141 (26 1967)
Excursion Secretary: Miss M. ALLENDER, 19 Hawthorn Avenue, Caulfield, 3161 (527 2749)
Book Sales Officer: Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Group Secretaries

Botany: Mr. MICHAEL McBAIN, 19 Foster St, St Kilda, 3182 (534 2293)
Day Group: C/- National Herbarium, The Domain, South Yarra, 3141.
Geology: Mr. T. SAULT, C/- National Herbarium, The Domain, South Yarra, 3141
Mammal Survey: Mr. RAY GIBSON, 26 McCulloch Street, Nunawading, 3131 (874 4408)
Microscopical: Mr. M. H. MEYER, 36 Milroy Street, East Brighton (596 3268)
Entomology and Marine Biology: Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)
FNCV Kinglake Nature Reserve: McMahons Road, Kinglake.
Bookings and keys: Mr. I. F. MORRISON, 788 Elgar Road, Doncaster (848 1194)

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 1981

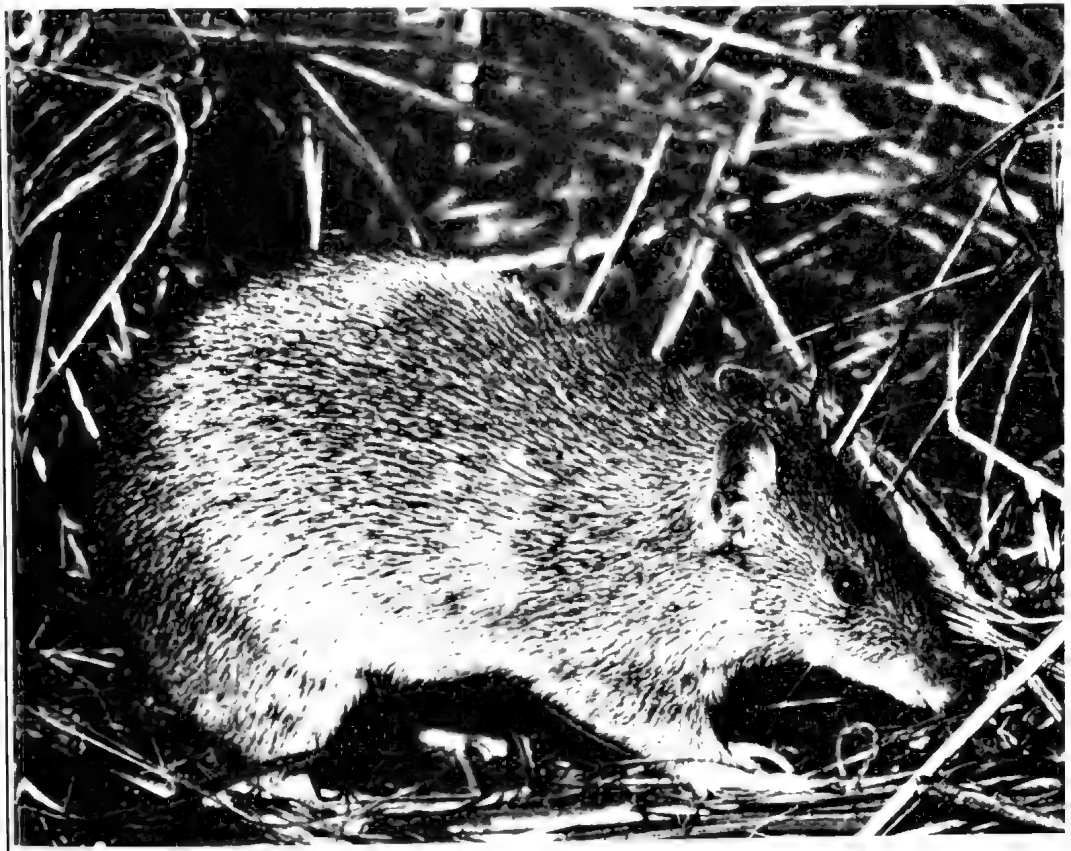
Metropolitan	$12.00
Joint Metropolitan	$14.50
Country Members and Retired Persons	$10.00
Joint Country and Joint Retired	$12.00
Junior	$2.50
Subscription to Victorian Naturalist	$10.00
Overseas Subscription to Victorian Naturalist	$12.00
Individual Journals	$1 75

All subscriptions should be made payable to the Field Naturalist Club of Victoria and posted to the Subscription Secretary.

JENKIN BUXTON PRINTERS PTY. LTD., WEST MELBOURNE

The Victorian Naturalist

Vol. 98, No. 3
May/June
1981



Published by the FIELD NATURALISTS CLUB OF VICTORIA
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$1.75

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GENERAL MEETINGS

At the National Herbarium, the Domain, South Yarra.

Monday, 15 June, 8.00 p.m.

Film night — a film on the Terrania Creek rain forest made by the Native Forests Action Council will be shown.

Monday, 13 July, 8.00 p.m.

Mr J. Ros Garnet will be presented with his Honorary Membership and will speak on "Reminiscences of the FNCV".

Monday, 10 August, 8.00 p.m.

Life history of squids. Speaker: Dr C. C. Lu.

New Members — May/June General Meetings.

Ordinary

Jane Calder, 146 Waiora Rd, Rosanna.
Neale Carr, 129 North Rd, Reservoir.
David Clark, 4 St Edmunds Gve, Glen Iris.
John Eichler, 3/217 Beach Rd, Black Rock.
Alda Heap, 8 Nathan Gve, Caulfield South.
Eve Mitchell, 7/146 Rupert St, West Footscray.
Harold Revell, Zoology Department, University of Melbourne.
Christine Shankley, 50 Glyndon Rd, Camberwell.

Joint

Mr and Mrs N. Bacon, 22 Rae Ave, Edithvale.
Philip and Trisha Maher, 94 Hunter St, Deniliquin.
Mr and Mrs W. Rocke, 55 Rowen St, Burwood.

Country

Trevor Hawkeswood, Botany Department, James Cook University.
Gwenda Newman, Health Care Centre, Warburton.
D. Wilbraham, 15 Kenwood St, Boolarra.

FNCV EXCURSIONS

Sunday, 7 June. Zoological Gardens. Meet at the main entrance at 11.00 a.m. Bring a picnic lunch.

Sunday, 5 July, Toorourrong Reservoir. A coach will leave Batman Ave at 9.30 a.m. Fare $5.50. Bring a picnic lunch.

Sunday, 2 August. Coolart. A coach will leave Batman Ave at 9.30 a.m. Fare $6.00. Bring a picnic lunch.

Sunday, 9 August. Studley Park. This year the Gardens Club is again organising a boneseed eradication day. We will join this united effort instead of having a day of our own and trust as many members as possible will attend. We have removed many 1000's of plants in the past and the improvement is quite noticeable. So keep up the good work. Meet at Kanes Bridge at 10.00 a.m. Bring gloves and a picnic lunch. Make a list of native plants seen while working as the Botany Group is updating the old plant list.

Preliminary notices:

Saturday, 19 — Sunday, 20 September. Alexandra. The VFNCA is holding a springtime get-together hosted by the Alexandra/Yea FNC. Saturday afternoon excursion to Cathedral State Park. Depart from the Alexandra High School at 1.00 p.m. There will be an evening meeting at the High School at 8.00 p.m. and Sunday excursion to the McKenzie Flora Reserve. Meet at the same place at 9.00 a.m. A coach will be chartered and motel accommodation on DDB basis, at a cost of $45.00 per person. Riversdale Caravan Park is next to the school with on-site vans. Members camping or hiring vans should make their own arrangements.

Friday, 16 October — Friday, 6 November. New Zealand. Please note change in day of departure; the party will now leave on Friday, 16 October. The extra day will be spent at Hicks Bay, and other slight changes have been made to the itinerary. More bookings are desired for this excursion and should be made with the Excursion Secretary accompanied by a $50.00 deposit.

Special study trips:

The next special study trip will be in September.

The Victorian Naturalist

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Cover illustration: Southern Short-nosed (Brown) bandicoot, *Isoodon obesulus* (Shaw and Nodder, 1797). Photo: Dr. J. Owen.

Early Introductions of Birds to Victoria* †

BY ROSEMARY BALMFORD, ‡

Two streams of thought can be seen to have led to the introduction of animals and plants from other countries to the young colony of Victoria in the 1850's and 60's.

The better documented stream joined Victoria, even then, to an international movement for the acclimatisation of animals and plants, formally initiated by the establishment in Paris in 1854 of La Société Impériale d'Acclimatation (Buckland, 1861).

The other stream, with the still waters which run deeper, stemmed from the desire of the homesick settler to recreate in a new and unfamiliar landscape some of the familiar sights and sounds of home, a powerful incentive to individuals to take great trouble to bring about the introduction of birds, and especially of singing birds.

Beauty was associated with the familiar, and its familiarity enhanced its beauty. Men and women struggling to establish themselves in a harsh environment are not to be blamed for failing to respond to its beauties as their descendants could; it was in 1870 that Adam Lindsay Gordon, who had arrived in this country in 1853 at the age of twenty, wrote of "songless bright birds". Brian Elliott (1976) suggests that the absence of the birds traditionally referred to in literature was resented — the nightingales, thrushes, skylarks and "usual poetical birds of the European repertoire" were missing and the local birds did not replace them.

A Committee of the Legislative Assembly was appointed in 1857, during the first session of the Victorian Parliament, to consider the importation of live stock. After giving due consideration to the means of improving the breed of sheep in the colony, it found itself reporting that "your committee think that the bush solitudes of Victoria should be invaded by some of the myriads of feathered fowl which gather in clouds in other, but not fairer, lands, and that the vast nations of indigenous quadrupeds which throng over distant and less civilised scenes, should add their quota to give voice and life, activity and food, to where now, scarcely disturbed but by the cry of the laughing jackass, the almost unbroken repose of ages holds its sway over the lovely inland districts of Australia Felix".

This appreciation of the beauty of the new country was unusual; and was combined with a feeling that it was incomplete without the familiar birds and animals of the old.

The Old Bushman, H.W. Wheelwright, a sensitive observer of the native birds and animals, speaks for all in the colony when he says " . . . larks have been imported from England and turned out wild. It will be a cheering sound in the ear of that man who has but lately left his English home, the clear shrill note of the Skylark in this land, where no single bird has any one long-continued song. Nowhere are British cagebirds more prized than in Australia, and the simple carol of one of our commonest home songsters, when heard in a foreign land, cannot fail to raise pleasurable emotions even in the rudest and most untutored mind, for it speaks a language of youth and home familiar to all" (Wheelwright, 1861).

The generally acknowledged founder and consistent inspirer of the formal ac-

* Common names are those used in sources.

† This article first appeared in *The Australian Bird Watcher* in 1978. Permission to reprint it was kindly granted by the Bird Observers Club.

‡ 459 The Boulevard, East Ivanhoe, 3079 Victoria.

climatisation movement in Victoria was Edward Wilson of *The Argus* newspaper. Both streams can be seen exerting their influence through Wilson. In a paper read before the Philosophical Institute of Victoria in July 1857 (Wilson, 1858) he argued for the introduction of song birds into Victoria, and suggested that first efforts should be concentrated on the skylark and the nightingale.

"It may appear to some" he said, "a trivial thing to be devoting our efforts in such a direction, while so much has to be done for the colony in matters of essential importance. But I confess that I am inclined to attach great consequence to the diffusion of these minor delights, and to estimate very highly their beneficial effects upon a people. There is a peculiar charm about the song of the skylark on a fine spring morning or that of the nightingale during one of its own calm summer nights . . . There may be a great deal doubtless, in the associations by which they are surrounded. But it is the peculiar characteristic of these interesting creatures to so surround themselves."

The other stream, however, appears when Wilson, on a visit to England in 1860 wrote a letter to *The Times* drawing the attention of the public to the importance of acclimatisation, and the need for governments to give financial support to the cause as the Victorian Government had done. It had been suggested to him that a great want in England was "a domestic animal not too large when killed to be consumed by a middle class family and the flesh of which should be meaty rather than poultry like", and that this need could be supplied by the wombat.

This unexpected suggestion shows the nature of the international acclimatisation movement; concerned to disseminate animals and plants throughout the world, and to establish them in countries other than those in which they were naturally found, but where it was felt they had a useful part to play.

Wilson was present at the first meeting, held in London in 1860, of the Society for the Acclimatisation of Animals (Buckland, 1861). When he returned to Victoria the Acclimatisation Society of Victoria (after 1872 the Zoological and Acclimatisation Society) was established at a meeting held on February 25, 1861 and presided over by the Governor, Sir Henry Barkly. Its objects were almost identical with those of the London Society, the only changes being necessary alterations of place.

So the Victorian Society was established for:-

"The introduction, acclimatisation and domestication of all innoxious animals, birds, fishes, insects and vegetables, whether useful or ornamental; . . . the spread of indigenous animals etc. from parts of the colonies where they are already known to other localities where they are known; the procuring, whether by purchase, gifts or exchange of animals etc. from Great Britain, the British colonies, and foreign countries; the transmission of animals etc. from the colony to England and foreign parts, in exchange for others sent thence to the Society . . ." (and so on).

Despite Wilson's enthusiasm for song birds, the minutes show an emphasis on the useful; in 1862, for example, on receipt of a letter from a Mr Duffield offering to import birds, the reply stressed that "useful and edible birds would be preferred to those of merely ornamental character".

To mark the first year of the Society's operations, a lecture was given by Professor McCoy, Professor of Natural Science in the University of Melbourne, at the Annual Meeting in November 1862. He led the imaginations of his hearers to dwell upon "the great task which has been reserved for us — the stocking of our new country with all the more important, useful and ornamental

kinds of animals, whether quadrupeds, birds or fishes, which are to be found in other parts of the world in similar climates, but of which the vast continent of Australia has been left by nature most singularly and exceptionally destitute".

The international character of the acclimatisation movement is illustrated by a list of "enquiries" (which would today be called a questionnaire) put to the Society by the Governor in 1864 "at the instance of the Secretary of State for the Colonies". It is clear that the enquiries had been sent to all the British colonies and dependencies on the initiative of the Acclimatisation Society of Great Britain. The essential enquiries for present purposes were: "Is there any bird, indigenous or introduced to the country in which you reside which merits attention with a view to its acclimatisation in Great Britain or any of its dependencies?" and: "Do you know any bird existing elsewhere the introduction of which to the country in which you reside would be likely to be beneficial?"

The birds recommended by the Victorian Society, in answer to the first question, as appropriate for acclimatisation elsewhere, were the Emu, the Native Turkey or Bustard, the Wonga-Wonga Pigeon, the Mallee Hen, "quail of several species", the "so-called Magpies", Laughing Jackass, Black Swan, Cape Barren Goose and "other geese and ducks for instance *Anseranas leucogaster, Anas superciliosa, Bernicla jubata, Casarca tadornoides, Malacorynchus membranaceus*". The second of these mentioned, "breeds now readily in company with the European Wild Duck, which it meets in the wild state, as introduced by the Acclimatisation Society of Victoria". The society's pride in the achievement in interbreeding seems strange today; Frith (1967), for this very reason, recommends that Mallard be shot on sight. Mallard and Mallard hybrids are classified as "noxious wildlife" and unprotected under the Victorian Wildlife Act 1975.

With the aid of a substantial grant from the Victorian Parliament, as well as subscriptions and donations, the Society established at Royal Park what is now the Melbourne Zoo. Initially the establishment was intended as a holding place for birds and animals acquired by the Society in order that they might be put in good condition and where necessary their numbers increased by breeding with a view to liberation for acclimatisation. Only in later years did Royal Park acquire its character as a general zoological gardens for visiting by the public, with exhibits not intended for ultimate release.

The Appendix gives details of birds which had been liberated by the Society in the first twelve years of its existence, taken from the Annual Report for 1873. It should be remembered that considerable efforts were also being devoted to other species, notably alpaca and cashmere goats, camels and salmon, and thought was being given to other desirable imports such as silkworms, glow worms, Secretary Birds (which were reputed to eat snakes) crabs, lobsters and oysters. In the list of birds the two approaches are apparent again: the song birds and swans for delight; the game birds for sport and good eating. Had all the introductions succeeded, the character of the avifauna of Victoria would be markedly different today.

Wheeler (1967) lists the following introduced species as at that date established in Victoria: Feral Pigeon, Spotted Turtle-Dove, Mallard, Blackbird, Song Thrush, Red-whiskered Bulbul, Skylark, House Sparrow, Tree Sparrow, Goldfinch, Greenfinch, Starling and Indian Mynah. The Ring-necked Pheasant, Spice Finch and Mute Swan have subsequently been added to this list (Wheeler, 1977), but these can be presumed to derive from more recent introductions. Thus it can be seen that the efforts of the Society largely failed.

Difficulties there were in plenty. The game birds were sent to the properties of interested members for breeding up — to Mr Austin of Barwon Park, famous in Australian history for the acclimatisation of the rabbit, to Edward Henty of Portland and to others. But it was hard to protect them from the uncontrolled depredations of shooters: in May 1862, Mr McHaffie of Phillip Island complained of the visits of trespassers with dogs and guns, and notices were to be posted on Phillip Island reading "All persons are hereby cautioned not to shoot or disturb the birds" (note: not "the introduced birds") on this Island, they being preserved for the Acclimatisation Society of Victoria."

Native hawks wrought havoc among the song birds, and the Society was anxious for their destruction; the purchase of a gun and ammunition for this purpose, was authorised in June 1862; but Wilson is recorded in the minutes of September of the same year as writing that "as those vermin did not exterminate the native birds, there was no reason to suppose they would the imported ones when once they were established".

There were frequent complaints of the activities of small boys with shanghais. In July 1862 the Society sent a circular to all Victorian municipal councils advising them of the coming into operation of the Act for the Preservation of Native Game and asking them to bring in "a bylaw for the protection of *all* (sic) native birds (excepting hawks) within the bounds of the municipality" (the protection of the Act being given only to certain listed species classified as 'game') and "giving power to the Police in all cases to prevent the use of the catapult (or shanghai) by the means of which instrument not only are the native birds rapidly disappearing from the vicinity of our towns but the English birds imported at so much care and expense are frequently destroyed. Were such a bylaw vigorously enforced for a few months this fast growing nuisance would be abated and the birds instead of becoming scarcer would quickly increase and multiply around us."

The interest of the Society in native birds was in fact manifested chiefly by the collection of live specimens for exchange with kindred bodies overseas in return for species it was hoped to acclimatise in Australia.

The records show a flourishing active society; enjoying the support of many members; consistently under Vice-regal patronage; encouraging the formation of similar bodies in the other colonies; triumphantly recording in its annual reports the establishment in the wild of still more species; and ever warmly conscious of the value of the task it had undertaken.

Space does not permit a full history of the Society and of its gradual change to a body conducting a zoological gardens instead of a programme of acclimatisation. But the material exists for such a study, and an outline has recently been published (Jenkins, 1977). What is harder, perhaps impossible, to discover, is the extent of private introduction of birds; to which I now turn.

Some clues appear from the records of the Society. The Council minutes from time to time record exotic birds as presented to or bought by the Society; these are to be presumed to have been privately imported; they had clearly not been imported by the Society.

In September 1862 letters were sent to people in different parts of the colony suggesting the formation of local branches of the Society to assist in the work of acclimatisation. At the Council meeting held on September 30, 1862, replies were produced from Echuca, Portland, Creswick, Heyfield, Maryborough, Lake Hindmarsh, Castlemaine, Warrnambool, Beechworth and Walmer.

"Nearly every gentleman asks for English song birds" remarked the Council in its minutes *"and these frequently*

arrive in ships from England" (italics added) "and are sold into captivity, whereas if they were purchased" (by local branches) "and set free they would speedily become plentiful throughout the colony". Again, these birds were private importations.

There was sufficient interest in the subject for A.P. Bartlett, Superintendent of the Zoological Society's Gardens at Regent's Park, London, to publish in the *Ibis* of 1862 several pages of "Remarks on the Mode of Preparing and Keeping live Thrushes and other Birds intended for Shipment to Australia".

But introductions were well under way before the formation of the Acclimatisation Society. In March 1853 *The Argus* reported that four white swans had arrived in Melbourne on the *"Medway"* and been presented to the Botanical Gardens.

The files of that newspaper for 1854 and later years tell the story of a shipment of songbirds brought from England by one Robert Morrice "a settler of many years standing". A number of birds died on the voyage, but seven Skylarks survived to be liberated on the Barrabool Hills, near Geelong. They were reported singing months later by a traveller from the diggings, sixty miles away near Kyneton. The anonymous contributor to *The Argus* on October 26, 1854 (most likely Edward Wilson, at that time editor) wrote that R.H. Horne (the poet, who had arrived in Melbourne in 1852) had suggested that Australian birds did not lack the ability to sing, but that they needed teaching. Wilson, if it be he, was prepared to agree that with the introduction of song birds "the powers of our indigenous songsters might be improved. They have voices, but have never been taught to use them". Skylarks, according to *The Argus*, were recorded in Flemington Road in October 1855, near Geelong in October 1857, near Kilmore in December 1857 and on the Barrabool Hills in November 1858.

In January 1856, a dealer imported for sale 800 canary birds, bullfinches, larks and other singing birds. In April the same year one Brender, who had brought to Sydney a large number of birds including thrushes, linnets, skylarks, chaffinches and starlings, was proposing to send some of them to Melbourne for sale. In January 1857 *The Argus* followed these two reports by recording the arrival of "a German gentleman with a large number of canaries, thrushes, blackbirds, robins, goldfinches, linnets, larks and starlings" and five nightingales; and called for donations to enable the nightingales to be purchased for liberation. Java sparrows (presumably, from the context, free-flying) were recorded in the Botanical Gardens in November and December 1856 (*The Argus* July 14, 1857).

And *The Argus* continued to chronicle the arrival of birds. Six dozen blackbirds and thrushes were shipped to Victoria on the *"Severn"* in August 1857. "Several pairs of sky and wood larks, goldfinches and linnets" arrived in November of that year in the *"Sydenham"*. A dealer called Neymaler landed his third shipment of birds in Victoria in January 1858 — nightingales, canaries, larks, blackbirds, thrushes, starlings and gold and silver pheasants. A Mr Rushall in October 1858 brought in the *"Norfolk"* seven partridges, "several pheasants of the silver, pied, white and common kinds" and blackbirds, thrushes, linnets, goldfinches and larks. The writer in *The Argus* of October 21 stated "pheasants are already breeding in the colony". In December Mr Neymaler's fourth shipment arrived — nightingales, canaries, larks, thrushes, blackbirds and several golden pheasants.

The *"Goddess"* landed 11 pheasants in February 1859, and in March, 28 pheasants, two blackbirds and a thrush

arrived at Geelong, consigned to Mr Austin.

The Times of London, quoting *The Australian and New Zealand Gazette*, records on October 18, 1859 the arrival in Melbourne of four dozen thrushes, consigned by Wilson; and on August 10, 1860, this time quoting *The Argus*, tells of the arrival in Melbourne by the *"Norfolk"* of three larks, nine thrushes and thirty-seven blackbirds, all sent by Wilson.

On December 27, in the same year, again citing *The Argus*, it states that many English birds were breeding in the aviaries in the Melbourne Botantic Gardens, and the thrushes were breeding also in the open air; the starling and blackbirds which were brought out by the *"Lincolnshire"* and the *"Essex"* were recovering from the voyage; and "a number of the pheasants, blackbirds, thrushes and larks received from England have been set free in the islands of Western Port and no doubt they are fairly established there".

On April 6, 1860 *"The Times"* own correspondent in Melbourne wrote:

"Honour to Edward Wilson! The charming singing birds which he despatched by the *'Great Britain'* have arrived safely with few casualties. Out of the forty-two thrushes and fifty-five larks shipped, no less than thirty-seven of the former and forty-three of the latter have been successfully established in the Botanical Gardens. Of twelve pairs of pheasants, only seven cocks and four hens remain alive".

Whatever the intended fate of the birds brought out by dealers and no doubt sold as cage birds, anything imported by Wilson was clearly destined for liberation with a view to acclimatisation.

The Old Bushman, who returned to England in 1859 (or perhaps in 1856: (Chisolm, 1976)) and in any event before the establishment of the Acclimatisation Society, records that skylarks had been liberated; he once saw a white swan flying in the wild and knew of a tame pair kept in the Cremorne Gardens, Melbourne. Pheasants he knew of as having been imported, but so far, he believed, confined to aviaries; although he knew of a cock-pheasant having been shot a few years before in a patch of tea-tree a few miles from Melbourne, no doubt having been deliberately released (Wheelwright, 1861).

Thus, independently of the activities of the Society, birds were being introduced. Some, no doubt, escaped, and many were being released in the wild with a view to acclimatisation. This being so, various confident statements in the literature as to the date of first introduction of sundry species should be read with caution. It is unlikely that the *first* date of introduction of any species will ever be known; and many unrecorded introductions must have taken place. Attempts have been made to ascertain the precise origin of introduced species (Sage, 1956 & 1957; Le Souef, 1958 & 1964; Keve, 1976) in order to determine what subspecies produced the Australian stock. Le Souef worked from the minutes of the Acclimatisation Society.

Sage relies on Ryan (1906) who gives particulars of date and place of first liberations and number of individuals liberated for twenty-three species; and similar details for a number of later liberations of the same species. Colonel Ryan was closely involved with the activities of the Acclimatisation Society, having been President in 1878 and 1899; he was to be President again in 1912-16. Thus it might have been assumed that he is speaking of liberations by the Society and obtained his information, which is detailed and specific, from the Society's records.

However, he mentions the Society only once, as having liberated some pheasants, and it is not possible to infer from the article that the other liberations to which he refers were in fact car-

ried out by the Society, or by any other specific person or organisation. No names are given.

Further, his information is inconsistent with the published records of the Society. For example, he gives 1863 as the date of the first liberation of Starlings, Thrushes, Californian Quail and Skylarks, and 1864 for the Blackbird, all of which are listed by McCoy in his lecture as having been liberated by the Society before June 1862. The Report of the Provisional Committee to the members of the Society on August 7, 1862 states that "The Thrush, Skylark, Blackbird and probably the Starling, may now be considered permanently established amongst us, the three former being heard in all directions".

The Skylark was, as shown above, present in 1854; whether these individuals survived and produced descendants cannot now be known; but 1863, the date of first introduction as given by Ryan, is clearly incorrect in this case; and his dates are likely to be incorrect in other cases. Wheeler (1967) also gives dates of first liberation which appear to be derived from the published reports of the Society.

It is easy to envisage the settler, returning to England on a visit, acquiring a cage of birds and nursing them through the long voyage back to Australia to relieve what was to him a dreary wilderness; or buying the birds brought out to Melbourne by dealers; and liberating them optimistically in the hope that they would establish themselves. Today we regret his efforts; but we should not judge him too harshly. It is only in the last ten to fiteen years that most of us have considered native plants to be suitable for our gardens; the botanical importations of our homesick ancestors have seemed to us until lately the only plants worthy of domestication.

Our attitude to the introduced birds has for a long time been different. Partly this change arose from an early revulsion against the fruit eating propensities of some of the exotic species. Complaints against Sparrows and Mynahs on this ground were voiced at the sixth annual meeting of the Society in 1868. And at a Council Meeting of the Society as early as June 3, 1862 "the Starling was specially objected to, as being reported to destroy the eggs of other birds".

Private introductions and liberations continued, however, John Ritchie of Blythevale, near Streatham, some 160 km west of Melbourne, had Turtle Doves in his garden in November 1869, and a large cage of canaries, "but all the blackbirds and thrushes died which he turned out some time ago". (Lewis, 1869). Dr George Nicholson is reported as liberating Thrushes, Blackbirds and Skylarks near Ballarat in 1876, and as having imported (and presumably liberated) other birds in 1867 and 1870 or 1871. All his birds came from Ireland, mostly from County Cork (Barrett, 1926).

Changing attitudes in later years are demonstrated by the treatment of the introduced birds in the standard bird books and other lists. Keartland contributing to *The Handbook of Melbourne* for the use of members of the Australasian Association for the Advancement of Science, which met at the University of Melbourne in 1900, produced an otherwise comprehensive list entitled *"Birds of the Melbourne District"* which made no mention at all of any introduced species. Robert Hall (1899) and (1900), listing Australian birds and insectivorous birds of Victoria respectively likewise ignored them. In 1907 he at least dealt with the introduced birds, although in a separate chapter, as did Lucas and Le Souef (1911). Leach in his first edition (1911) was ahead of his time in realistically including them in systematic order. The first edition of Cayley (1931) included no illustrations of introduced birds, although some were described, and in the 1958 edition a separate plate depicting introduced

species was added. Mack (1935) listed them separately at the end of his account of the birds of Victoria.

Whittell (1954) in his entry on Le Souef (1890), felt constrained to add "includes information on introduced birds" almost apologetically, as though such a reference was hardly appropriate in a work entitled *"The Literature of Australian Birds."* Wheeler (1967) lists the introduced species in systematic order as they come, recognising them as an integral part of the avifauna, as do Slater (1970 and 1974), the *Victorian Year Book* for 1966 (Anon, 1966), and Macdonald (1973).

The 1926 Checklist (RAOU, 1926) ignored the introduced species; the 1975 Checklist (Condon, 1975) and Interim List (Shodde, 1975) included them.

In 1969 the Gould League produced what must be the first Australian bird book with a starling on the cover; *Birds of Victoria: Urban Areas;* accepting reality and recognising the place of the exotics in the region with which the book was concerned. Over 70% of the people of Victoria live in Melbourne (Anon, 1977) and for them, the common, obvious birds are the introduced birds.

The introductions of exotic birds to Victoria and the other Australian colonies (Jenkins, 1977) formed part, but only part, of the activities of the official, organised acclimatisation movement and of the private individuals desirous of recreating in a strange land the familiar sights and sounds of home.

I am indebted to Allan McEvey for pointing out that both groups were assuming man's dominion over the animal kingdom; it was for man to arrange the creatures wherever in the world he wished to do so. The eighteenth century neo-classical love of order, seen also in the landscape gardens of the period, imposed itself upon the natural world; and the nineteenth century acclimatisers moved in that tradition, exemplified by McCoy's peroration quoted above. Among the Victorian colonists it seems that there was as yet no place for the romantics, prepared to accept, to marvel at, and later to study, nature in its primeval state.

There is not space here to examine today's ambivalent attitudes to the established introduced species.

Let the last word be with C. J. Dennis' Starling, chattering in 1935:

"Men rave and count us enemies
And many strive to work us ill.
Yet pray remember, if you please,
That we are here not at our will.
Some homesick exile brought us hence
To be a solace for his grief
So, spite of all our grave offence,
Can't you forgive a cheery thief?"

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APPENDIX
BIRDS LIBERATED IN VICTORIA BY THE ACCLIMATISATION SOCIETY OF VICTORIA TO 1873

At the Botanical Gardens

18 Canaries
18 Blackbirds
14 Thrushes
6 California quail
80 English wild ducks
35 Java sparrows
4 English robins
8 Turtle doves
50 Mainas

At Phillip Island

4 Chinese partridges
70 Chinese quail
23 Tasmanian quail
6 Starlings
10 Algerine sand grouse
6 Wild ducks

5 Pheasants
6 Skylarks
6 California quail
4 Thrushes
4 Blackbirds
1 Pair white swans
5 Cape pheasants
8 English pheasants
4 Indian pheasants
8 Ceylon partridges
5 Indian partridges

At Sandstone and Churchill Islands
4 Pheasants
4 Skylarks
4 Thrushes

At Yarra Bend
6 Thrushes
4 Skylarks

At the Royal Park
2 Thrushes
20 Greenfinches
15 Yellowhammers
200 Java sparrows
6 Blackbirds
20 Siskin finches
6 Powi birds
3 Partridges
6 Pheasants
10 English robins
20 Mainas
6 Starlings
60 English sparrows
40 Chaffinches

At St. Kilda
20 Chinese sparrows

At Ballarat
5 English sparrows
20 Java sparrows

At Cape Liptrap
10 Pigeons
4 Ceylon peafowls
4 Guinea fowl

At Plenty Ranges
10 Pheasants
4 Jungle fowls
7 Guinea fowls

Liberated in the Bush in 1870
30 Pheasants
25 Skylarks
A number of doves
20 Guinea fowl
10 Pea fowl

Liberated in the Bush in 1871
150 Guinea fowl
15 Pheasants

Liberated in the Bush in 1872
50 Pheasants
A number of Californian quail
17 English robins
20 Guinea fowl

In addition to the above, 54 pheasants had been sold and distributed to members of the Society.

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A Short History of the Discovery and Naming of Banksias in Eastern Australia

Part II Sir James Edward Smith

By A.I. Salkin*

The "First Fleet" of convicts and soldiers landed at Botany Bay on January 18th, 1788. By a strange coincidence the ships of a French "scientific" voyage of exploration anchored in the bay eight days later (Scott, 1916). This was the ill-fated expedition under the command of La Perouse which was to meet a tragic end at Vanikoro (Stafleu, 1966) in the Santa Cruz group of islands, in the Solomons.

The motives for the settlement in New South Wales are the subject of much debate but one thing that is quite clear is that it provided an opportunity for scientific material to be sent from Australia to England. Thomas Keneally (1967) in his novel "Bring Larks and Heroes" gives something of the flavour of this period and how the convicts were used in this trade in exotics either as collectors or illustrators. There was officially a monopoly on all material of scientific interest and this was under the direct control of Sir Joseph Banks. The botanical material was intended for the Royal Botanic Gardens at Kew and only a few rarities were allowed to be distributed to the King's favourites through the offices of Banks. Banks however did not employ a collector in New South Wales until 1791; he was David Burton, a superintendent of convicts who applied to Banks directly for the position. Banks' reply to Burton gives a clear picture of the importance attached to the monopoly.

"I mean by offering you 20 pounds a year to engage you (to) collect for me seeds of Plants, Living Plants when you can and specimens of Plants and that you engage not to supply any other person directly or indirectly with any vegetable production the other two kingdoms of nature are open to you." (Banks, 1791 in Gilbert, 1962)

In the meanwhile, Banks was supplied by Governor Philip with seeds and plants.

The monopoly that Banks sought to establish merely made a clandestine trade in botanical and zoological curiosities more probable, and also more profitable. Not only were naval and military officers engaged in this "trade" but so also was anybody else who had or claimed knowledge pertaining to these matters.

The trade in botanical curiosities was much older than the settlement of Australia. New plants suitable for both agriculture and horticulture were as important, if not more so then, as they are now. Botanical collectors risked their lives in the jungles of South America and the mountains of India and China collecting for this trade. The King's garden at Kew merely gave added status to this penchant for acquiring rarities. Magazines were published that described new species as they were brought into cultivation. The best of these were in many ways scientific works, their titles give some idea of the market to which the information was intended. The Curtis Botanical Magazine, one of the most influential of these publications, continues to be published under a bequest from George Bentham and presumably fulfils a similar service to the original ones which were:

"The Botanical Magazine: or Flower Garden Displayed; in which the most ornamental Foreign Plants, cultivated in the Open Ground, the Green House,

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and the stove are accurately represented in their Natural Colors . . . A work intended for the use of such Ladies, Gentlemen, and Gardeners as wish to become scientifically acquainted with the plants they cultivate."

The first volume of the "Curtis Botanical Magazine" was published in 1787. A very early volume, Volume 6 Plate 738 deals with "Banksia ericaefolia" (sic). After a latin generic and species description together with synonyms and illustrations this description follows —

"The Banksia is a genus so named in honor of its first discoverer, the President of the Royal Society, in a voyage round the world with Captain Cook, is very nearly allied to Protea, and like that appears to contain a great number of species of various forms and size. Our present plant forms a handsome shrub, thrives freely, and has flowered in several collections; our drawing was taken from that of E.J.A. Woodford, Esq. at Vauxhall in April 1802.

The beauty of the flower consists very much in the length of the style; which from the stigma being long retained within the anthers, is fancifully bent into a loop: when the efflorescence is complete, the petals expand and let the stigma at liberty. The flower is considered by some as monopetalous, but the petals, in Banksia ericaefolia (sic) at least, adhere so slightly at the base only, that they can hardly be kept from separating when removed from the receptacle. The germen (ovary) in this species is surrounded by brown hairs very like many of the Protea. We could not discover any other calyx than the squama (bracts) of the Amentum (spike), in no respect like that described by Gaertner. A native of New-Holland. By no means tender, and may be kept in a greenhouse with Proteas and other Cape shrubs. Propagated by seeds and cuttings."

"The Botanist's Repository" by Henry Andrews was not a magazine, but was published in parts between 1797 to 1815. The full title describes clearly the aims which were in the best traditions of natural history —

"The Botanist's Repository for New and Rare Plants containing coloured figures of such plants, as have not appeared in any similar publications with all their essential characters botanically arranged after the sexual system of the celebrated Linnaeus in English and Latin. To each description is added a short history of the plant as to its time of flowering, culture, native place of growth, when introduced and by whom."

In many cases "The Botanist's Repository" achieved what it set out to do and a number of plant species were first described in the publication. *Bauera rubioides* is one of a number of descriptions that were published in this way.

The most influential of these botanical publications and one that concentrated entirely on the flora of Australia was "A Specimen of the Botany of New Holland" (Smith, 1793). The author Sir James Edward Smith, founder of the Linnean Society, acted as the patron of Mr. John White who accompanied Captain Phillip as Surgeon-General to the colony of New South Wales. White's medical training made him a suitable observer and collector because medicine was largely concerned with obtaining drugs from plants, botany being part of medical training.

Of the plants that White sent back, 27 were described as new species in the "Specimen", a further 37 were described in "Exotic Botany" (Smith, 1804), of these 64 new plants only one new *Banksia* species was described. It is important to realise that so far none of the *Banksia* spp. at that time discovered had been described by the person who collected it and none of the material was retained in Australia. This poses many problems for anybody doing research in Australia and the reverse is true of

researchers in England. Smith never saw plants growing in the field in Australia. He no doubt saw plants growing in greenhouses but because of phenotypic plasticity this is a poor substitute for field work. Smith appears to have been aware of these problems because as well as the pressed specimens White sent him there were also sketches; these were probably done by the convict artist Thomas Watling (Rientis, 1963). The seventh *Banksia* spp. at that time discovered had to be described was *B. spinulosa*. The pressed specimen is still in the Linnean Society's herbarium and is in a remarkably good state of preservation; it consists of 3 sprays with 3 flowers in various stages of development. The "worked up" coloured illustration is by James Sowerby who was also the publisher. Whilst the illustration is a little mechanical in its treatment, there is no doubt as to which species this is. This is of importance as there are a number of variants in the *B. spinulosa* complex. The species description supports the illustration and it is given below to illustrate the nature of the botany of this period, the dual role that it served, and the mixture of science with the dissemination of popular gardening information.

"Banksia spinulosa

Prickly-leaved Banksia

Gen. Char. Receptaculum commune elongatum, squamosum. Cor. tetrapetala. Stamina limbo inserta. Capsula bivalvis, disperma interjecto seminibus dissep imento mibili Common receptacle elongated, scaly. Cor. of four petals Stamina inserted into the limb. Capsule with two valves, two seeds and a moveable partition between them.

Spec. Char. B. foliis linearibus mucronulatis apicem versus denticulato-spinosis.

Leaves linear, revolute, with a little sharp point, and with spinous denticulations towards the top.

This hitherto non-descript (undescribed) species of *Banksia* has a woody branched stem, the branches commonly three or more together, curved upwards, leaves irregularly scattered, closely covering the branches, on very short footstalks (petioles), but little spreading, from an inch and half to two inches in length, linear, very narrow, revolute in the margin, green and smooth above, white and downy beneath, ending very abruptly, tipped with three little spines and having several of the same kind hooked upwards in the margin particularly towards the top. The young leaves are very downy. Flowers thick set in a cylindrical erect spike arising from the divarications of the branches. Their common receptacle is cylindrical, rather obtuse covered with closely imbricated downy scales, some of the lowermost of which terminate in a long downy arista and from among the rest the flowers come out in pairs. The structure of the flower is well expressed in the annexed plate. We suspect the fruit figures in Mr White's voyage page 225 fig 1. may belong to this species but we have no positive proof to assert it.

Our Banksia spinulosa differs from B. ericaefolia (sic) of Linnaeus (Herb. Linn.) in having leaves at least four times as long, obtuse but with a small central sharp point on the mid rib between the other two terminal points as well as having a greater or lesser of small sharp-hooked lateral teeth towards the end of each leaf. The natives of New south Wales call it 'Wattangre'."

The cone illustrated by White (1790) is probably not as suggested from the *B. spinulosa* described by Smith but, may be from another member of the complex or from one of the forms of *B. ericifolia*.

There is evidence that White sent other *Banksia* specimens to Smith. The Linnean Society holds a number of specimens of *B. integrifolia* as well as one labelled *B. cuneata* which appears to be the juvenile foliage of *B. integrifolia* but may be one of the forms of the complex it forms with *B. marginata*. There is

also a specimen of *B. serratifolia* Salisb., (*B. aemula* R. Br.) and another of *B. aspleniifolia* Salisb., (*B. oblongifolia* Cav.) and it is the presence of these in the Linnean Society Herbarium which is an important clue to one of the bitterest controversies in banksia taxonomy.

Other Anderson descriptions that are still valid are *Callicoma serralifolia, Crowea saligna, Daviesia ulicifolia, Persoonia linearis, Styphelia tubiflora, S. viridis, Ziera Smithii.*

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Mammal Survey Group Contribution No.13

Mammals of the Wallaby Creek Catchment

BY B. A. CALLANAN*

Introduction

From September 1974 to November 1978 the mammal fauna of the Wallaby Creek Catchment of the Melbourne and Metropolitan Board of Works (MMBW) was examined by means of a series of sample surveys. A total of 1108 trap-nights and 42.4 spotlight hours resulted in nine native and five introduced mammal species being recorded.

Wallaby Creek Catchment is situated on the Great Dividing Range approximately sixty kilometres north north-east of Melbourne. It adjoins the Broadford State Forest to the west and pine and hardwood forests, mixed farming, grazing and closer settlement to the east.

The catchment forms part of Melbourne's water supply system and public entry is prohibited. We are indebted to the MMBW for permitting controlled entry of our group for these distribution studies. Logging is not undertaken within the area — management being oriented towards protection from fire and water supply interests.

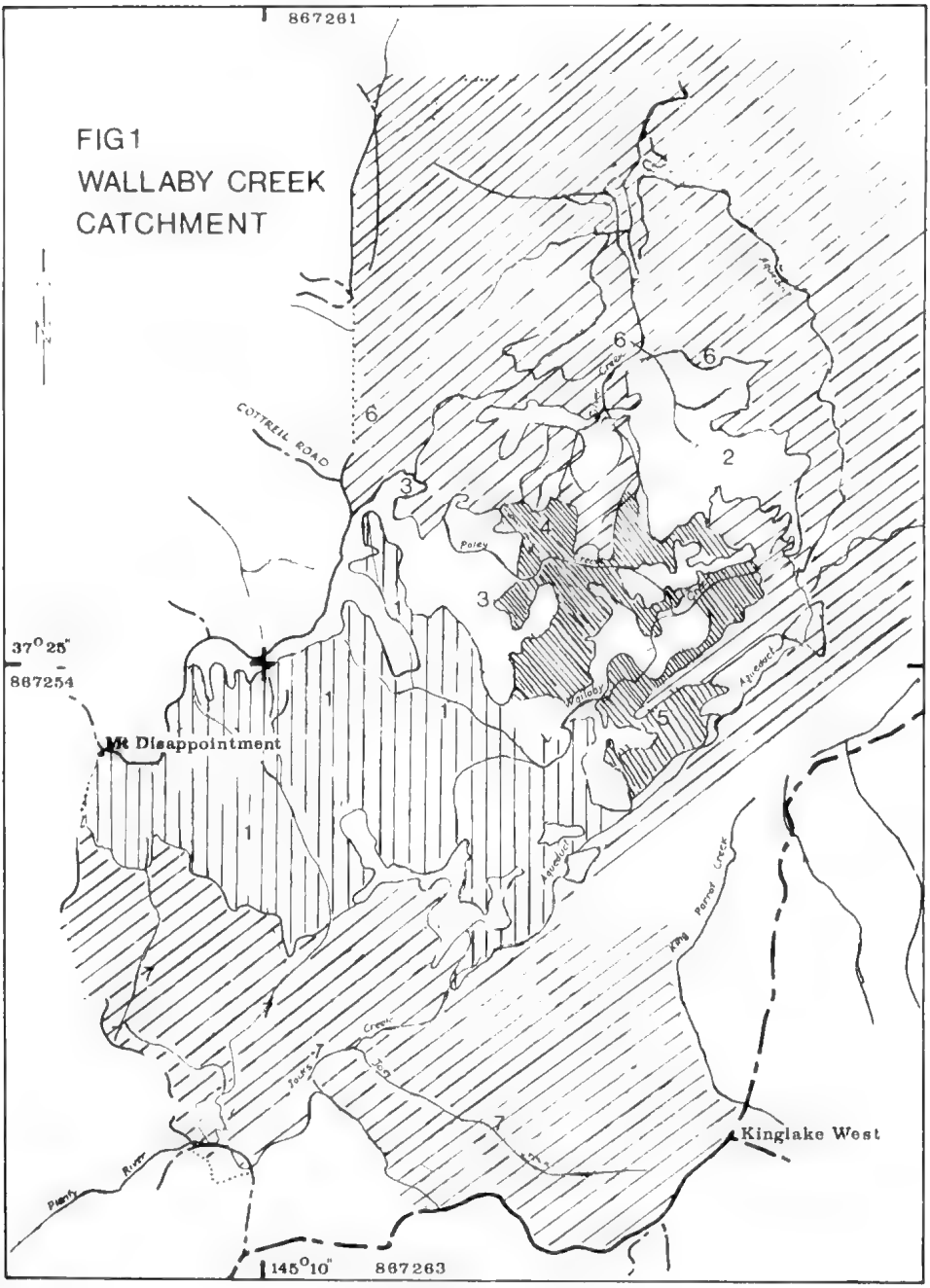
The extent of the examination is resolved for this report into seven specific study areas distributed throughout five major vegetation associations, defined as Mature Mountain Ash, Regrowth Mountain Ash, Unstocked Ash Site, Northern Mixed Eucalypt Species and Southern Mixed Eucalypt Species. These are shown in Fig. 1.

(*Mammal Survey Group, c/- Secretary 26 McCulloch Street, Nunawading.)

Methods

Within each study locality live trapping and spotlighting were the basic survey methods used. Chance sightings and daylight observations of mammals during the survey were recorded.

Survey work included an examination of the


867261
FIG1
WALLABY CREEK
CATCHMENT
COTTRELL ROAD
37°25"
867254
Mt Disappointment
145°10"
867263
Kinglake West
Mature Mountain Ash
Regrowth Mountain Ash
Unstocked Ash Site
Mixed Eucalypt Species
SCALE 1:75000
0 1 2 3 4 5 Km

habitat of each study locality. The method developed by Specht (1970) was used as the basis of vegetation description in the field. Where necessary to complete the structural definition of the vegetation type, descriptions of intermediate, shrub and ground cover layers of vegetation have been used.

Description of Study Area

Geology and Physiography

A detailed description of the geological features of the area local to Wallaby Creek has been published (Land Conservation Council 1973).

The higher parts, including the mature Mountain Ash areas, are based on a granite formation which reaches its highest elevation of 800 m at Mount Disappointment just on the south-west boundary. The main plateau level corresponds to the Kinglake Geological surface.

The localities of sample surveys varied in elevation between 400 m on the southern escarpment to 750 m in the mature Mountain Ash area.

Climate

Table 1 gives rainfall and temperature figures for stations in the study area. They are from published data (Bureau of Meteorology 1966) and information supplied by the MMBW from the Disappointment Reference Area Management Plan, March 1979, MMBW. The Disappointment plateau is in a cool temperate zone with an average annual rainfall of approximately 1200 mm and a pronounced winter maximum.

The plateau normally experiences wet winters and comparatively dry summers. Precipitation is generally in the form of rain with occasional hail and infrequent rapidly melting snow.

Rainfall records have been kept since 1885 at the Wallaby Creek settlement on the north-eastern edge of the plateau. The table gives the monthly and annual long-term average rainfall at the settlement for the period 1885-1978, and for comparative purposes, Toorourrong which is south of the plateau and at a lower elevation, (1893-1978).

Rainfall records taken on the plateau in mature Mountain Ash agree closely with the Wallaby Creek figures.

Temperature records for the plateau are not available. Estimates taken from mean isotherm charts (Director of Meteorology, 1968) are shown in Table 3.

Temperature ranges are generally moderate, however frosts occur throughout the year and it could be expected that dew point is reached on most nights of the year. Summer temperatures can occasionally rise as high as 35°C or more.

Streams

The major streams draining the area form two groups, the first draining south into Toorourrong Reservoir, the remainder flowing north to where they are intercepted and channelled back across the Great Dividing Range into Toorourrong Reservoir. If not intercepted the south flowing streams would enter the Plenty River and the northerly streams would flow to the King Parrot Creek.

Vegetation

For the purpose of this report the habitats present in the Wallaby Creek catchment are divided into five types as follows:

Mature Mountain Ash
Regrowth Mountain Ash
Unstocked Ash Site
Northern Mixed Eucalypt Species (Northern Plateau)
Southern Mixed Eucalypt Species (Foothills)

Figure 1 outlines the distribution of the main habitat types.

A general description of the vegetation of the area has been published (Land Conservation Council 1973).

A brief description of the vegetation at each survey locality is given below. Species names are drawn from Willis (1970, 1972).

Mature Mountain Ash

Centred on the high dividing range to the east of Mt Disappointment, the mature Mountain Ash at Wallaby Creek was not destroyed by the 1926 and 1939 bushfires. The fire of 1926 burnt into part of this destroying some but leaving most, while the fires of 1939 did not approach near to the area.

Table 1. **Climate.**

Rainfall (mm) — Monthly Means from all Records

	Jan	Feb	Mch	Apr	May	Jne	Jly	Aug	Sep	Oct	Nov	Dec	Year
Wallaby Creek Settlement	64	61	72	97	116	133	127	131	119	117	97	86	1223
Toorourrong	54	56	58	66	70	66	64	73	76	82	70	66	801

Temperature (°C) — Estimates from Mean Isotherm Charts (Director of Meteorology 1968)

		Jan	Apr	Jly	Oct	Year
Catchment	Max	23	17	9	16	16
Plateau	Min	9	7	2	6	6

The locations of specific survey efforts in this habitat type are shown in Fig. 1.

The upper storey is a tall open forest of almost pure Mountain Ash standing 50 to 70 m high and having a canopy cover from 50 to 60 percent of total forest surface area.

On the verge of the southern slopes Mountain Grey Gum *Eucalyptus cypellocarpa* merges progressively with Mountain Ash as altitude decreases.

The intermediate storey beneath the mature Mountain Ash varies from open to quite dense near the heads of gullies and streams. Species present include Mountain Correa *Correa lawrenciana*, Silver Wattle *Acacia dealbata*, Blackwood *Acacia melanoxylon*, Hazel Pomaderris *Pomaderris aspera*, Musk Daisy Bush *Olearia argophylla*, Blanket-leaf *Bedfordia salicina*, taller Victorian Christmas Bush *Prostanthera lasianthos*, with occasional Southern Sassafras *Atherosperma moschatum* and Austral Mulberry *Hedycaria angustifolia*.

Species present in the shrub and heath layer include Silky Tree Fern *Dioksonia antarctica*, Rough Tree Fern *Cyathea australis*, Prickly Current Bush *Coprosma quadrifida*, Victorian Christmas Bush *Prostanthera lasianthos*, Rough Coprosma *Coprosma hirtella* and Sweet Bursaria *Bursaria spinosa*. The density and variety of shrubs is greatest near streams and varies elsewhere with the amount of available light.

At the heads of well lit south-east facing gullies tall shrubs are quite dense, including, with the above, Golden-tip *Goodia lotifolia*, Snowy Daisybush *Olearia lirata*, Common Dogwood *Cassinia aculeata*, Bootlace Bush *Pimelea axiflora*, Prickly Moses *Acacia verticillata* and Holly lomatia *Lomatia ilicifolia*.

The ground cover beneath the Mountain Ash varies with the amount of light and moisture available. Leaf litter and fallen tree limbs are present throughout.

Some areas are sparsely covered below the spindly stems and branches of Mountain Correa and hazel Pomaderris. In other relatively flat and more damp areas, ferns and sedges from knee to waist high form entanglements around fallen logs and hanging branches of tall shrubs. Ferns and creepers become more dense near streams when tree ferns do not completely block light penetration.

Species present include the hard Water-fern *Blechnum* procerum, Fishbone Water-fern *B. nudum*, Mother Shield Fern *Polystichum proliferum*, Saw Sedge *Gahnia* sp. and Austral Bracken *Pteridium esculentum*. Grasses are present but sparse.

In some more open areas the ground cover includes Hop Goodenia *Goodenia ovata*, mat rushes and patches of non-stinging nettle.

Regrowth Mountain Ash

Two specific survey efforts in regrowth Mountain Ash were located centrally between Poley Creek and the head of Stoney Creek, and to the northeast. (Ref. Fig. 1).

Fig. 2. Mature Mountain Ash forest.

The upper storey of this habitat type is a tall ('poles') open forest structure of almost pure young Mountain Ash approximately fifty years old and reaching forty five metres high.

Amongst the closer trunks of the Mountain Ash regrowth the intermediate storey includes isolated Blackwood and Stinkwood *Zieria anborescens* but is much more sparse than in Mature Mountain Ash habitat.

The shrub layer in this habitat type has the structure of very sparse tall heath. Species present include Tree Lomatia, Common Dogwood and Prickly Moses.

Ground cover beneath the almost complete cover of young Mountain Ash is a light tangle of shrubs midst fallen forest debris. Species present include Austral Bracken, Clematis, Bootlace Bush and Hop Goodenia.

Unstocked Ash Site

Small isolated areas of the Wallaby Creek Catchment remain unstocked with the original Mountain Ash following its destruction by fire in 1926.

The upper storey of the remaining tall scrub habitat includes species which are usually intermediate beneath mature Mountain Ash habitat. The structure in some places particularly in the eastern area is a dense closed forest of Silver Wattle and Hazel Pomaderris groves. On more exposed positions in the central Unstocked Ash area the upper storey gives way to open bracken.

Fig. 3. Regrowth Mountain Ash forest.

The shrub layer of this habitat is almost absent in places where light does not penetrate. In more open areas Austral Bracken predominates and Sweet Bursaria and Common Dogwood are occasionally present.

Beneath the dense hazel and wattle, ground cover is sparse with some sedges and Prickly Starwort *Stellaria pungens*.

Specific work in the unstocked ash habitat type was located at two sites: an eastern site and a central site north of Poley Creek.

Southern Mixed Eucalypt Species

Five specific survey efforts in this habitat type, which is quite distinct from Northern Mixed Euc. Species habitat, were located as shown in Fig. 1. These included crossings of the Plenty River and Jacks Creek.

Fig. 4. Unstocked Mountain Ash forest.

The dominant vegetation of the southern excarpment is an open forest of mixed eucalypt species including Messmate *Eucalyptus obliqua*, Narrow leafed Peppermint *E. radiata* with some Mountain Grey Gum. Isolated Manna Gum *E. viminalis* occurs near streams.

The understorey and tall shrub layer is only noticeably present in damp gullies and includes Musk Daisy, Hazel Pomaderris, Blanket leaf, Victorian Christmas Bush, Silver Wattle and Prickly Tea Tree *Leptospermum juniperinum*. The shrub layer in this foothill forest is generally open however near streams it occasionally tangles together about 2 m from the ground. It includes Prickly Moses, Australian Clematis *Clematis aristata*, Silver Banksia *Banksia marginata*, Hop Goodenia *Goodenia ovata*, Narrow leafed Wattle *Acacia mucronata*, Bush Peas *Pultenea* sp. and Common Dogwood.

Austral Bracken Fern dominates the forest floor. Occasional rushes and sedges are also present in the ground vegetation which is generally sparse varying from a fairly dense fern and low shrub community immediately by stream channels, through dense bracken patches to dry open cover of grasses thin leaf litter with some herbs including small rice flower *Pimelea* sp., violet *Viola* sp., and Pink-bells *Tetratheca ciliata*.

Northern Mixed Eucalypt Species

Four survey localities were situated in the northern mixed eucalypt species habitat type including riparian habitat along Silver Creek.

Fig. 5. Southern Mixed Eucalypt forest.

Spotlighting was carried out near the Wallaby Creek settlement in the east and also on the west side of the survey area.

The upper stratum of this habitat type has a tall open forest structure at places closing to greater than 70% canopy cover. Species include Messmate, peppermint, Mountain Grey Gum with some Mountain Ash and Manna Gum.

The intermediate storey is a tall shrubland structure only really significant in cover and height near streams. Species include Silver Wattle, Prickly Moses and Hazel Pomaderris.

In other areas a very open sapling understorey is occasionally present.

The shrub layer forms an open heath structure of Austral Bracken, Hop Goodenia, Holly Lomatia *Lomatia* sp., Snowy Daisy Bush, Common Dogwood, Sweet Bursaria and Bush Pea. This merges with the ground cover which includes Kangaroo Fern *Microsorium diversifolium* and Common Ground Fern *Culcita dubia*.

Results

Table 2 lists all mammal species identified in each specific study area with the corresponding extent of survey effort expressed in numbers of trapnights and spotlight hours. This table indicates whether the animals were recorded during trapping, while spotlighting, or by chance. Table 2 lists also the proportions of survey success per species in each locality. For trapped species the figures in parentheses are the numbers captured per 100 trapnights while for species detected by spotlight the figures in parentheses are the numbers seen per 100 spotlight hours. These figures should only be used for comparison within each survey method for this report. In this table a dash means that the relevant survey method was not carried out whilst a zero indicates no positive results.

Fig. 6. Northern Mixed Eucalypt forest.

Table 3 allocates the species recorded to specific minor grids numbered in accordance with Brook (1976). Again recordings per 100 trapnights and 100 spotlight hours are entered in parentheses for each species in each grid where applicable. The study area is situated mainly in the three minor (5min x 5min) grid localities 867,25.4, 867,26.1 and 867,26.3 with a small part situated in minor grid locality 867,26.2. For the purposes of this report all species identified are located within the three former grids.

Notes on Species Recorded

The specimen catalogue numbers refer to specimens lodged with either the Fisheries and Wildlife Division or the National Museum.

ORDER MARSUPIALIA — Family Macropodidae

1. Grey Kangaroo — *Macropus giganteus* Shaw

Two specimens were located along the boundary of the central Unstocked Ash and Northern Regrowth Ash. A further two specimens were sighted in the Southern Mixed Eucalypt Species habitat.

2. Black Wallaby — *Wallabia bicolor* (Desmarest)

This species was recorded from five habitat types, two (12.5%) in Mature Mountain Ash, three (43%) in Central Ash Regrowth, one (chance) in Unstocked Ash Site, five (50%) in Northern

Table 2. **Mammals Recorded**

	SURVEY LOCALITIES							
	Mature Mountain Ash	Ash Regrowth		Unstocked Ash Site		Mixed Eucalyptus Species		Total
		Northern	Central	Central	Eastern	Northern		
	1	2	3	4	5	6	7	
Trap Nights	450	80	161	76	60	106	175	1108
Spotlight Hours	16	-	7	-	-	8	11.4	42.4
Species Trapped (Numbered as in 'Notes on Species')								
8 *Antechinus stuartii*	23 (5.1)	0	8 (5.0)	0	0	0	17 (9.7)	48 (4.3)
9 *Antechinus swainsonii*	7 (1.6)	0	2 (1.2)	1 (1.3)	0	0	2 (1.1)	12 (1.1)
10 *Rattus fuscipes*	73 (16.2)	16 (20.0)	6 (3.7)	10 (13.2)	6 (10.0)	11 (10.4)	7 (4.0)	129 (11.6)
11 *Rattus rattus*	0	0	0	0	0	0	1 (0.6)	1 (0.1)
14 *Mustela putorius*	0	0	0	0	1 (1.6)	0	0	1 (0.1)
Species Identified During Spotlighting								
1 *Macropus giganteus*	0	-	1 (14.3)	-	-	0	0	1 (2.4)
2 *Wallabia bicolor*	2 (12.5)	-	3 (42.9)	-	-	4 (50)	0	9 (21.2)
3 *Trichosurus vulpecula*	0	-	1 (14.3)	-	-	0	0	1 (2.4)
4 *Pseudocheirus peregrinus*	12 (75.0)	-	1 (14.3)	-	-	2 (25)	0	15 (35.4)
5 *Schoinobates volans*	3 (18.8)	-	0	-	-	1 (13)	1 (8.8)	5 (11.8)
7 *Vombatus ursinus*	3 (18.8)	-	1 (14.3)	-	-	3 (38)	0	7 (16.5)
12 *Oryctolagus cuniculus*	0	-	0	-	-	5 (63)	0	5 (11.8)
13 *Vulpes vulpes*	0	-	0	-	-	1 (13)	0	1 (2.4)
15 *Cervus unicolor*	0	-	0	-	-	1 (13)	0	1 (2.4)
Species Recorded by Chance During the Survey								
1 *Macropus giganteus*			1				2	2
2 *Wallabia bicolor*					1	1	3	5
6 *Acrobates pygmaeus*						2		2
7 *Vombatus ursinus*						1	1	2
12 *Oryctolagus cuniculus*				3				3
13 *Vulpes vulpes*							1	1

Figures in parentheses are — for trapped species — numbers captured per 100 trap nights.
— for species detected by spotlight — numbers seen per 100 spotlight hours.

Table 3. Minor Grid Location of Species.

Minor Grid Location	Specific Survey Effort		Mammal Species (numbered as in 'Notes on Species')														No of Species in grid
			1 (Mg)	2 (Wb)	3 (Tv)	4 (Pp)	5 (Sv)	6 (Ap)	7 (Vu)	8 (Ast)	9 (ASw)	10 (Rf)	11 (Rr)	12 (Oc)	13 (Vv)	14 (Mp)	15 (Su)	
	Trap nights	Spotlight Hours																
867,25.4	60	—	—	—	—	—	—	—	1*	5	1	0	0	—		0	—	2
			—	—	—	—	—	—	—	(8.3)	(1.7)	0	0	—	—	0	—	
867,26.1	423	15	1	8*	1	3	1	2*	4	8	3	43	0	8*	1	0	1	13
			(6.7)	(47)	(6.7)	(20)	(6.7)	0	(27)	(1.9)	(0.7)	(10)	0	(33)	(6.7)	0	(6.7)	
867,26.3	625	27.4	3*	4*	0	12	4	0	4*	35	8	86	1	0	1*	1	0	9
			0	(7.3)	0	(44)	(15)	0	(11)	(5.6)	(1.3)	(14)	(0.2)	0	0	(0.2)	0	
No of grids located in			1	2	1	2	2	1	2	3	3	2	1	1	1	1	1	

* Figures include chance recordings but figures in parentheses do not.

Mixed Eucalypt Species, and three (chance) in Southern Mixed Eucalypt Species.

The Black Wallaby was the second most commonly spotlighted species following the Ring-tailed Possum.

Family Phalangeridae

3. Brush-tailed Possum — *Trichosurus vulpecula* (Kerr)

Only one specimen was recorded from the Central Ash Regrowth site (14%).

Family Petauridae

4. Ring-tailed Possum — *Pseudocheirus peregrinus* (Boddaert)

The Ring-tailed Possum was recorded from three habitat types. Twelve (75%) animals were sighted in Mature Mountain Ash, two (25%) were seen from Northern Mixed Eucalypt Species and one (14%) specimen was recorded from central Ash Regrowth.

5. Greater Glider — *Schoinobates volans* (Kerr)

The Greater Glider was recorded from three habitat types. Three (19%) animals were seen in Mature Mountain Ash, one (14%) in Northern Mixed Eucalypt Species and one (9%) in Southern Mixed Eucalypt habitat. No Greater Gliders were recorded from Regrowth Mountain Ash or Unstocked Ash Site.

Family Burramyidae

6. Feathertail Glider — *Acrobates pygmaeus* (Shaw)

The Feathertail Glider was not seen during survey work, however two recordings of this animal were made (C. Curry pers comm.) during tree felling operations in the Northern Mixed Eucalypt habitat just outside the catchment during the survey period.

Family Vombatidae

7. Wombat — *Vombatus ursinus* (Shaw)

The Wombat was recorded from four habitat types. Three (19%) specimens were seen in Mature Mountain Ash, one (14%) in central Ash Regrowth, and three (38%) in Northern Mixed Eucalypt Species. Single animals of this species were also sighted by chance in Northern and Southern Mixed Eucalypt habitats.

Wombats were sighted twice as often in Northern Mixed Eucalypt habitat than in Mature Mountain Ash where they appeared slightly more often than in central Ash Regrowth.

Family Dasyuridae

8. Brown Antechinus — *Antechinus stuartii* Macleay

The Brown Antechinus was recorded from three types of habitat. Twenty three specimens (5.1%) were taken in Mature Mountain Ash, eight (5.0%) in central Ash Regrowth and seventeen (9.7%) in Southern Mixed Eucalypt Species.

The Brown Antechinus was not recorded in Unstocked Ash habitat or Northern Eucalypt species.

Following the Bush Rat it was the second most commonly trapped species. It was consistently caught in Mature Mountain Ash and central Ash Regrowth. It was trapped in above average numbers for this survey in Southern Mixed Species while it was in apparently low numbers in Northern Mixed Species and Unstocked Ash habitat where no specimens were taken during the survey.

Catalogue specimens: NMV — C 22186, 17677, 17675, 17676.

Catalogue specimens: FWD 8611, 8612, 8613.

9. Dusky Antechinus — *Antechinus swainsonii* (Waterhouse)

The Dusky Antechinus was recorded in four types of habitat. Seven specimens (1.6%) were trapped in Mature Mountain Ash, two (1.2%) in central Ash Regrowth, one (1.3%) in central Unstocked Ash Site, and two (1.1%) in Southern Mixed Eucalypt habitat.

This species was more abundant in Mature Mountain Ash where 7 out of a total of 12 animals were taken. Recordings of this species in Mature Mountain Ash were approximately fifty per cent higher than in other areas in which it was trapped. The only recording of *A. swainsonii* in Unstocked Ash Site was a trapping made during the daylight hours on the second complete day in which the traps were in place.

ORDER RODENTIA — Family Muridae

10. Bush Rat — *Rattus fuscipes* (Waterhouse)

The Bush Rat was caught in all habitat types and was the most commonly recorded animal. Seventy-three specimens (16%) were taken in Mature Mountain Ash, sixteen (20%) in northern Ash Regrowth, six (3.7%) in central Ash Regrowth, ten (13%) in central Unstocked Ash, six (10%) in eastern Unstocked Ash, eleven (10%) in Northern Mixed Eucalypt Species and seven (4.0%) in Southern Mixed Eucalypt habitat.

The results indicate a very large difference in population size between the northern and central Ash Regrowth sites which was recorded five times more often in the former area.

Catalogue specimen: NMV — C22185

11. Black Rat — *Rattus rattus* (L)

The introduced Black Rat was recorded only from the Southern Mixed Species habitat where one (0.6%) specimen was taken.

ORDER LAGOMORPHA — Family Leporidae

12. Rabbit — *Oryctolagus cuniculus* (Lilljeborg)

The introduced Rabbit was recorded from Northern Mixed Eucalypt Species where five animals (63%) were seen while spotlighting and from the central Unstocked Ash Site where three specimens were seen by chance.

ORDER CARNIVORA — Family Canidae

13. Red Fox — *Vulpes vulpes* (L)

The introduced fox was recorded from only the Northern and Southern Mixed Eucalypt species habitats. One specimen (13%) was recorded during spotlighting in the former and one animal was sighted by chance, in the latter.

Family Mustelidae

14. Ferret — *Mustela putorius*

The introduced ferret was recorded only from the Eastern Unstocked Ash Site where one specimen (1.6%) was captured.

The ferret captured was almost white in colour.

Family Cervidae

15. Sambar Deer — *Cervus unicolor*

The introduced Sambar Deer was seen only in and near Northern Mixed Eucalypt Species habitat and in the open grazing areas near the Wallaby Creek Office and buildings. One specimen (13%) was recorded during spotlighting in the former area.

Discussion

The recordings of Eastern grey kangaroo were isolated incidents in open areas to the north and south of the taller Mountain Ash forests. This species is apparently in low numbers here.

The Black Wallaby is apparently quite abundant on the open fire-break areas near the Manna Gum plantation and in the Northern Mixed Species area leading down to the Wallaby Creek Settlement.

The Brush-tailed Possum does not appear to be as abundant in this area as it does generally in the forested areas of Victoria. Graeme Ambrose (pers. comm.) indicates this species to be in low numbers in his nest box study area which was located in a combination of habitats including Unstocked Ash Site, Northern Mixed Eucalypt Species and Regrowth Mountain Ash. It would occa-

sionally use a nest box as a roost, but preferred natural hollows. It chewed the entrances of many nest boxes but came and went without using them.

The Ring-tailed Possum is clearly more common in Mature Mountain Ash habitat where intermediate and tall shrub vegetation layers are well developed.

Ambrose indicates that the Greater Glider was very uncommon and did not use nest boxes in his study area.

The Feather-tail Glider very rarely used nest boxes but did make use of old Brown Antechinus globe nests which it relined and roosted in.

The Brown Antechinus was apparently low in numbers in Northern Mixed Species and Unstocked Ash Site where no specimens were taken during the survey. Ambrose however indicates that this was the most common species using his nest boxes and was also caught in trapping exercises in his study area and in Northern Mixed Eucalypt Species further north. Ambrose notes that this species nests in tree-holes and between rocks in outcrops. It builds a globe shaped nest of Eucalyptus leaves. Up to 23 animals were recorded from one nest — usually a second year female and number of young.

Where both Brown Antechinus and Dusky Antechinus were recorded in the same locality the number of the Dusky Antechinus was about 25% of the number of Brown Antechinus.

Ambrose did not record *A. swainsonii* from within his study area.

While the native Bush Rat was common in all areas and in all habitat types the results indicate that the introduced Black Rat is in quite low to negligible numbers.

Rabbit numbers in some northerly areas of the catchment appear comparable with the most commonly sighted native animal — the Black Wallaby. Rabbit dropping are very common also in roadside clearings and Unstocked Ash Site habitat.

It is common (MMBW staff pers. comm.) to sight the Sambar Deer at dawn and dusk as it forages along roadsides on cool and overcast days. Hazel pomaderris trees within the Ambrose study area have large bald patches where the deer rub their antlers.

Two species not recorded during the survey have been found by other workers.

The Long-nosed Bandicoot *Perameles nasuta* was not trapped during this survey. However, Ambrose (1979) has recorded this species from study areas in Unstocked Ash Site surrounded by Northern Mixed Eucalypt and Ash Regrowth near the junction of roads four and eleven. This species has also been recorded close to the Catchment at Mount Disappointment by the Mammal Survey Group of Victoria (Nicol 1978).

The House Mouse *Mus musculus* recorded by Ambrose (1979) within the catchment and by Nicol (1978) from Diggers Gully to the north of the Catchment was not taken during this survey, and is apparently in low numbers here.

Small insectivorus bats are numerous during the warmer months. None have been trapped and none identified from nest boxes despite one instance of a box being used by them.

Comparing the results in Mature Mountain Ash habitat with those in Regrowth Mountain Ash, almost the same species were present in both. However, Ring-tail Possum and Greater Glider are more common in Mature Mountain Ash than in Regrowth Ash.

The Unstocked Ash Site habitat does not appear to support as high a population of native mammals as do other areas. The Rabbit, however, is common in this habitat.

The Northern Mixed Eucalypt Species habitat appeared to contain the most varied arboreal fauna, particularly in contrast with Southern Mixed Eucalypt Species which contained the least. In contrast the latter contained three native

ground mammal species whilst only Bush Rat was recorded from the former.

Overall the Mature Mountain Ash habitat, particularly where other vegetation levels are present, contained the richest fauna. This was not however, as great as other similar areas in the state where the Sugar Glider *Petaurus breviceps*, Yellow bellied Glider *Petaurus australis* and Bobuck *Trichosurus caninus* are often found.

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Protected species of mammals were handled under the provisions of a permit issued by the Fisheries and Wildlife Division, Ministry for Conservation.

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Insect Pollination of *Angophora woodsiana* F. M. Bail. (Myrtaceae) at Burbank, South-east Queensland.

By T. J. Hawkeswood.*

Abstract

Field observations on insect pollination vectors of *Angophora woodsiana* F. M. Bail. (Myrtaceae), were made during the 12-15 December, 1980 at Burbank, south-east of Brisbane, Queensland (27° 35' S, 153° 29' E). Thirteen species of insects (including the honey-bee, *Apis mellifera* L.) were collected and their pollen loads examined and compared. Samples of fruiting branches of *A. woodsiana* indicated that a high percentage of seeds were produced. This is probably due to efficient self- and cross-pollination by the insect vectors.

Introduction

Little has been recorded on the insect pollination of *Angophora* species, although it is generally known and recorded in entomology texts, (e.g. Froggatt, 1907; McKeown, 1945 and Britton, 1970) that native bees and other insects visit blossoms for nectar and pollen. Investigations by the author during the past several years in various areas of Australia have suggested that many *Angophora* and *Eucalyptus* species are insect pollinated (e.g. Hawkeswood, 1981). Further evidence is provided here for *Angophora woodsiana* from the Burbank area of south-east Queensland.

Angophora is a small genus of trees in the Myrtaceae, comprising about eight species in eastern Australia. The genus is very closely related to *Eucalyptus* in floral morphology, pollen, seedling, leaves, bark and timber (Debenham, 1961) and consequently, there have been moves to include *Angophora* as a subgenus of *Eucalyptus*.

Angophora woodsiana is a medium-sized tree to about 12m high, with flaky and rather brittle, light-brown bark and a large spreading crown. The adult leaves are opposite, shortly stalked, oblong to lanceolate, mostly 10-18 cm long, 1.2-3.6 cm wide, coriaceous, on relatively long petioles to 2.5 cm in length, dull green above, slightly paler below. The flowers, with numerous, free, cream stamens, are arranged in corymbose panicles at the ends of the branches, with usually 3-7 buds in each umbel. The ovary is inferior, 3- or 4-celled with numerous ovules attached to the axis. The flowers when fully open, measure about 1.5-1.8 cm in diameter. They produce copious quantities of nectar which collects in a depression between the ovary summit and the rim of the calyx-tube and often covers the whole ovary summit. The anthers are versatile and the parallel cells open longitudinally. The fruit is ovoid or cylindrical, mostly 1.2-1.8 cm long, often narrowed at the rim, with five main ribs and 3 or 4 enclosed valves.

A. woodsiana is restricted to a few localities in southern Queensland and the north of New South Wales (Debenham, 1961), occurring in dry sclerophyll forest on sandstone or deep, sandy soils through its range. It is a mass-flowering species during November to December, although not all plants within a population flower each year. Numerous young trees, about 3-6 m high flowered in the Burbank area of south-east Queensland during early to mid December, 1980 (as well as an occasional larger tree). The low flowering branches made easier observations on the insect pollination vectors than the high flowering crowns of older trees.

Since surprisingly little is known about the pollination ecology of Australian Myrtaceae, and *Angophora woodsiana* offered excellent op-

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portunities for such study, this project was undertaken in order to determine some of the pollination vectors, their behaviour on flowers and their pollen loads.

Materials and Methods

(a) Collection of vectors and pollen examination

Insects were collected from the flowers of *A. woodsiana* and carefully deposited in large plastic jars containing ethyl acetate. They were later examined for pollen loads at James Cook University, Townsville, with the aid of a high-power dissecting microscope. Pollen grains were usually clearly visible as small to large clusters adhering to hairs and the general body surface. Pollen grains from a few selected beetles were compared with those from a preserved flower of *A. woodsiana* under a high-power (x400 — x1000) binocular microscope. The examination showed that the grains were identical and thus proved beyond doubt that the beetles were carrying *A. woodsiana* pollen. A list of the vectors and data showing places of pollen deposition are provided in Table 1.

Voucher collections of most of the species examined are deposited in the Australian National Insect Collection (ANIC) in Canberra. Voucher collections of *A. woodsiana* are deposited in the Queensland Herbarium, Brisbane.

(b) Study areas

Three study sites were chosen in the Burbank area off Kloske and Rochedale roads. Five flowering plants were examined for vectors at Site 1, seven at Site 2, and six at Site 3. All sites were within 1km of each other. The vegetation in these areas was dominated by *A. woodsiana* but few individuals were in flower. Other plants included species of *Casuarina* (Casuarinaceae), *Tristania* (Myrtaceae), *Xanthorrhoea* (Xanthorrhoeaceae), *Leucopogon* (Epacridaceae), *Acacia* (Mimosaceae) and various grasses (Poaceae). *A. woodsiana* was the only species in flower at the time, although *Xanthorrhoea* sp. had just finished flowering.

(c) Observation times

Observations were made during 1100hrs-1500 hrs (EST) each day from 12-15 December, 1980. During this period, insects were most active. Each site was examined for about 1 hour in the order of Site 1, 2, 3. Most of the time was taken simply observing the behaviour of the pollination vectors on the flowers, interactions between insects and inter-plant movements. Some of these data are presented in Table 2.

(d) Collection of seed material

In order to gain some indication of pollination success, samples of young fruit with seeds were collected from two trees growing at Site 1 on the 16 December, 1980. No seed had been produced by any of the other trees at Sites 2 or 3. The data obtained are presented in Table 3.

Results

(a) Observations on insects and their pollen loads

In total, thirteen species of insects, all beetles (Coleoptera) except for *Apis mellifera* L. (Apidae: Hymenoptera) were collected from the flowers (Table 1). Suprisingly, no native flies (Diptera) or wasps (Hymenoptera) were encountered on the flowers. Other studies (Hawkeswood, 1975, unpublished data on *Eucalyptus crebra* F. Muell. and *E. gummifera* (Gaertn.) Hochr. in the Blue Mountains of New South Wales, and Ashton (1975) on *E. regnans* F. Muell. in Victoria), have shown that native flies, bees, wasps and butterflies also visit flowering eucalypts in association with beetles, and it could be assumed

Table 1. Pollinators of *Angophora woodsiana* F. M. Bail. at Burbank, south-east Queensland. (Places of pollen deposition on insects shown by asterisks. Underline marks show where the majority of pollen was placed on the majority of specimens examined).

Species	No. of specimens collected	Estimated no. of individuals present during study periods	Place of pollen deposition					
			Antennae	Head	Eyes	Thorax	Abdomen and legs	Elytra (or wings)
Site 1.								
COLEOPTERA								
Scarabaeidae								
1. *Eupoecila australasiae* (Donovan)	12	50+	*	*	*	*	*	*
2. *Glycyphana stolata* (Fabricius)	5	20+	*	*	*	*	*	*
3. *Phyllotocus macleayi* (Fischer)	2	20+	*	*	*	*	*	*
4. *Polystigma punctata* (Donovan)	10	80+	*	*	*	*	*	*
Cerambycidae								
5. *Aridaeus thoracicus* (Kirby)	1	c.5	*	*	*	*	*	*
6. *Clytus curtisii* Laporte & Gory	3	c. 10		*		*	*	
7. *Clytus durvellei* Laporte & Gory	3	c. 30		*		*	*	
8. *Eroschema poweri* Pascoe	1	2		*	*	*	*	*
9. *Stenocentrus ostricilla* (Newman)	1	c. 10		*		*	*	
10. *Trichomesia newmanii* Pascoe	2	4				*	*	
Cleridae								
11. *Scrobiger* sp.	2	c. 20		*	*	*	*	*
Cantharidae								
12. *Chauliognathus* sp.	2	c. 20		*		*	*	
HYMENOPTERA								
Apidae								
13. *Apis mellifera* L.	5	100+	*	*	*	*	*	*

Site 2.								
COLEOPTERA								
Scarabaeidae								
1. Eupoecila australasiae (Donovan)	2	50+	*	*	*	*	*	*
2. Polystigma punctata (Donovan)	2	50+	*	*	*	*	*	*
Cerambycidae								
3. Clytus curtisii Laporte & Gory	2	c.20		*	*	*	*	
4. Trichomesia newmanii Pascoe	1	c.10			*	*	*	
Cleridae								
5. Scrobiger sp.	3	c.30	*	*	*	*	*	
Cantharidae								
6. Chauliognathus sp.	1	c.10		*		*	*	
Site 3.								
COLEOPTERA								
Scarabaeidae								
1. Eupoecila australasiae (Donovan)	2	50+	*	*	*	*	*	*
2. Glycyphana stolata (Fabricius)	2	20+	*	*	*	*	*	*
3. Phyllotocus macleayi (Fischer)	2	c.20	*	*	*	*	*	*
4. Polystigma punctata (Kirby)	4	50+	*	*	*	*	*	*
Cerambycidae								
5. Aridaeus thoracicus (Kirby)	1	2	*	*	*	*	*	*
6. Clytus durvellei Laporte & Gory	2	c.30				*	*	*
7. Stenocentrus ostricilla (Newman)	2	c.10	*	*	*	*	*	
Cleridae								
8. Scrobiger sp.	2	c. 20	*	*	*	*	*	*
HYMENOPTERA								
Apidae								
9. Apis mellifera L.	3	100+	*	*	*	*	*	*

+ This is the style of presentation given by Nilsson (1978).

that *Angophora* also attracts a similar species of pollination vectors since the floral morphology and attractants such as the pollen and nectar are similar, if not identical, to *Eucalyptus*.

The majority of pollination appears to be effected by the large scarab beetles *Eupoecila australasiae* (Donovan) (body length 1.5-1.8 cm) and *Polystigma punctata* (Donovan) (body length 1.3-1.5 cm) (Scarabaeidae) (Table 2). These are perhaps two of the most common and widespread beetles in eastern Australia and appear adapted to the pollination of numerous summer-flowering native plants e.g. *Bursaria spinosa* Cav. (Pittosporaceae), *Angophora bakeri* C. Hall and *Eucalyptus gummifera* (Gaertn.) Hochr. (Myrtaceae) in New South Wales (Hawkeswood, 1975, unpublished data). In particular, *P. punctata* has moderately pubescent undersurfaces and legs. (Table 2) which help facilitate the adsorption, transport and deposition of pollen grains. The majority of self-pollination of *A. woodsiana* is probably effected by these two scarabs, as well as some cross-pollination since numerous inter-plant movements were observed (Table 2). Pollen was carried

Table 2. Qualitative data on morphology and behaviour of the twelve species of native pollinators of *A. woodsiana* at Burbank, South-east Queensland.

Species	Body Length* (cm)	Degree of + pubescence	Activity: Feeding on one group of flowers only	Activity: Mating	Inter-plant movements
Scarabaeidae					
1. *Eupoecila australasiae* (Donovan)	1.5–1.8	3	Commonly observed	Commonly observed	Commonly observed
2. *Polystigma punctata* (Donovan)	1.3–1.5	2	"	"	"
3. *Diphucephala colaspoides* Burmeister	0.7–1.0	4	"	Not observed	Occasionally observed
4. *Phyllotocus macleayi* (Fischer)	0.7–0.8	1	"	"	"
Cerambycidae					
5. *Aridaeus thoracicus* (Kirby)	2.5–2.7	3	"	"	"
6. *Clytus antilli* Laporte & Gory	1.5–1.8	3	Occasionally observed	Commonly observed	"
7. *Clytus darvellei* Laporte & Gory	1.6–2.0	3	"	"	"
8. *Troschera rowei* Pascoe	1.2–1.3	3	"	Not observed	Not observed
9. *Stenocentrus ostricilla* (Newman)	1.8–2.0	4	Commonly observed	"	Occasionally observed
10. *Trichomesia newmanii* Pascoe	1.2–1.4	3	Occasionally observed	Occasionally observed	Not observed
Cleridae					
11. *Scrobiger* sp.	0.8–1.0	1	Commonly observed	Not observed	"
Cantharidae					
12. *Chauliognathus* sp.	1.0–1.2	2	"	"	"

Refer to Table 1.

*= From apex of head to tip of elytra.

+ = Degree of pubescence

1= Extremely hairy undersurface and legs

2= Moderately hairy undersurface and legs

3= Sparsely pubescent undersurface and legs

4= Few hairs present on body or glabrous

on all parts of the bodies in all specimens examined, with the majority of pollen grains being transported on the head, thorax and abdomen (Table 1).

E. australasiae has fine hairs on the undersurface and legs, with much of the general body surface glabrous. It is therefore likely to be less efficient in pollen adsorption that the hairy *P. punctata*. However, this may be offset by the sticky and conglomerative nature of the pollen, which adheres readily to the smooth surfaces of the beetles as well as to the hairs. Specimens of both *E. australasiae* and *P. punctata* were found with large clusters of pollen grains, both amongst hairs (abdomen) and on glabrous surfaces such as elytra and thorax (pronotum) (Table 1).

Most text books state that the majority of the sub-family Cetoniinae (Scarabaeidae) to which *Polystigma*, *Eupoecila* and *Glycyphana* belong, are usually destructive feeders on the petals and reproductive structures of flowers. Observations have shown that *P. punctata*, *E. australasiae* and *G. stolata* fed almost exclusively on nectar which collected in a shallow depression between the ovary summit and the side of the calyx-tube. A high degree of specificity appears to exist between *Eucalyptus* and *Angophora* flowers and these beetles, (Hawkeswood, 1975-1980, pers. obs.).

Of the scarabs, *Glycyphana stolata* (Fabricius) and *Phyllotocus macleayi* (Fischer), are also important pollinators (Table 1). However, their presence in fewer numbers (Table 1) and more sedentary behaviour indicate they may be less important in cross-pollination than *Eupoecila* and *Polystigma* but still important in effecting geitonogamous pollinations.

Six species of longicorn-beetle (Cerambycidae) were collected (Table 1). The most common of these was *Clytus (Chlorophorus) durvellei* Laporte & Gory (Table 1). Specimens of this species were most commonly observed in copulation (Table 2) either on the flowers or on branchlets beneath blossoms. Individuals were most active on the flowers although they did not always come in contact with the stigmas or anthers. They fed on nectar intermittently and a large proportion of their time was spent in copulation or crawling up and down branches. Although individuals carried pollen mostly on their abdomen and legs (Table 1), their role in cross-pollination of *A. woodsiana* is probably not as significant as that of the larger, more hairy scarab beetles which often scrape their bodies through flowers (stamens) and over stigmata.

Pollen was not usually detected on the antennae of the cerambycids (Table 1). Trace amounts of pollen were detected on the base of the antennae only, near the head of *Aridaeus thoracicus* (Kirby) and *Stenocentrus ostricilla* (Newman) (Table 1). The predominant absence of pollen on the antennae is probably due to the fact that most cerambycids have long, thick antennae which are extended back over their bodies and do not usually contact anthers. This is in contrast to the comparatively small, feathery antennae of the Scarabaeidae, which usually come in contact with the anthers since they are positioned downwards.

The behaviour and pollen loads of the other species of Cerambycidae were similar to that of *C. durvellei* (Tables 1 and 2). Overall, the small longicorn-beetles (body length < 1.8 cm) probably play a more important part in self-pollination than cross-pollination, since individuals tended to remain on one profusely flowering branch and did not usually take flight. No inter-plant movements by *Eroschema poweri* Pascoe and *Trichomesia newmanii* Pascoe were observed (Table 2).

The small clerid beetle, *Scrobiger* sp. (Cleridae) frequently fed on nectar from the flowers (Table 2) and in so doing, adsorbed pollen onto the undersurface, mostly on the abdomen and legs (Table 1). They were most active on the flowers and their rapid flight made observations

on them difficult. It is generally known that clerid beetles visit the flowers of native plants during summer (e.g. Britton, 1970) but observations by the author in New South Wales, Queensland and Western Australia (1975-1981) have suggested that species are not common. Subsequently, their role in pollination may not be so important as presently realized. Further studies are needed on these beetles before their role in pollination can be properly assessed.

The small cantharid, *Chauliognathus* sp. (Cantharidae) was also a visitor to the flowers (Table 1), often feeding on nectar from one or two flowers during each foray (Table 2). Small amounts of pollen were detected on the head, thorax, abdomen and legs (Table 1). Although these beetles were extremely active on the flowers, they rarely came in contact with the stigmata. Since flights to nearby plants were not observed (Table 1) this species may not be important in *A. woodsiana* pollination. Further observations are needed on these beetles since, despite their active nature and relative scarcity, they may be important in geitonogamous pollinations.

The feral honey-bee, *Apis mellifera* L. is well-known as a pollinator of a diverse range of plants throughout the world, and may even be more efficient than the scarab beetles in *A. woodsiana* pollination. However, since *A. mellifera* is an introduced species, it cannot be considered a natural pollinator and therefore, for purposes of this paper, comparisons of pollinator efficiency with native insects are not warranted.

(b) Seed set

A high percentage of flowers produced fruiting capsules with seeds (Table 3). The samples range from a 55.6% pollination success to 70%, with an average of 61.1% (Table 3). These figures could be higher if flowers with aborted ovaries and those adversely affected by boring and chewing insects (in both cases, the flowers fall from the trees early), were not taken into consideration. These parameters are difficult to measure. Usually, only fruiting capsules remain on the branches (in the case of *Angophora),* while both healthy flowers which are not pollinated and those which have suffered damage etc. fall early, leaving a peduncle scar. (Each

Table 3. The number of fruiting capsules in relation to the total number of flowers produced by Angophora woodsiana F. M. Bail. in each sample. (Samples 1-4 from Tree 1, samples 5-7 from Tree 2).

Sample Number	Total number of flowers in each sample	No. of fruits produced per sample	Percentage pollinated and producing mature fruiting capsules with seeds
1	33	19	57.5
2	30	20	66.6
3	4	3	75.0
4	36	24	66.6
5	46	32	70.0
6	44	27	61.3
7	27	15	55.5
Totals	240	141	61.1

scar has been counted as one flower which has not been pollinated (Table 3) regardless of whether flowers were damaged, contained aborted ovaries or were normal but failed to be pollinated, before abscission).

No germination tests have been made on the seeds from the capsules collected since at the time of collection, they were slightly immature. However, it is assumed for purposes of this paper, that the seeds have arisen from self- and/or cross- pollination (i.e. geitonogamy and xenogamy respectively), rather than through autogamous means. This assumption is based on work by Pryor, Chattaway and Kloot (1956) who stated that most eucalypts (and angophoras) are out-breeding.

Discussion

According to Pryor, Chattaway and Kloot (1956), most eucalypts are apparently out-breeding with protandrous flowers but are still selfcompatible (i.e. they are able to be self-pollinated) with viable seeds being produced as a result. Although Krug and Alves (1949) were generally unsuccessful in attempts at artificial self-pollination of *Eucalyptus alba* Reinw. in a Brazilian plantation, examination of certain recessive characters in this population led them to suggest approximately 23% of all seeds resulted from self-fertilization. In addition, in a study of allozyme genotypes in *E. obliqua* L Herit., Brown, Matheson and Eldridge (1975) suggested that 24% self-fertilization occurred in that species, while Eldridge (1970) suggested that 28% self-fertilization occurred in *E. regnans* F. Muell. Since self-fertilization averages about 23-28% in these examples, it is suggested that countervailing advantages (such as maintaining sources of variability within the gene-pool) exist in retaining a large portion of out-crossing.

If cross-pollination is also important in the genetic variability of populations of *A. woodsiana*, then the insects listed in this paper (Table 1), must play an important role in cross-pollinating flowers. It has been suggested (e.g. Ashton, 1975) that wind is a possible agent of pollination in eucalypts. However, after studying *E. regnans* in Victoria, Ashton (1975) found the pollen to be sticky and tended to adhere into clumps 10-200 um in diameter during and after anther dehiscence and therefore was probably unsuitable for wind transport to the stigmas of flowers on other plants nearby.

As mentioned earlier, little has been recorded on the pollination vectors of *Angophora*. Prakash (1969) noted that swarms of honey-bees visited the open flowers of *A. floribunda* (Sm.) Sweet during flowering time, as well as beetles, sap-sucking insects and wasps but did not investigate their pollen loads etc. More information on vectors is known for the closely related genus *Eucalyptus* and it seems appropriate to review some of this data. Barber (1965) postulated that pollination of *Eucalyptus* was effected by a wide range of agents including wind, insects, birds and mammals but did not provide any data on insect vectors, their behaviour nor their pollen loads. Ashton (1965) concluded, from a brief survey of insect vectors visiting *E. regnans* flowers at Wallaby Creek (about 65km NNE of Melbourne), that pollination was effected by these insects, many of which were abundant. He found (p. 403), that beetles (*Mordella* sp. (more likely *Mordellisterna* sp.) Mordellidae), feral honey-bees (*Apis mellifera* X *A. lusitanica* hybrids, Apidae), small native bees (*Leioproctus flavomaculatus* (Cockerell) and *Callomelitta picta* Smith, Colletidae), hoverfiles (*Eristalis* sp. (probably *E. tenax* L.), Syrphidae), blow-flies (*Anastellorhina stygia* (Fabr.), Calliphoridae), ants (*Myrmecia nigrocincta* Smith and *Iridomyrmex* sp., Formicidae), butterflies (*Oreixenica lathoniella herceus* Waterhouse and Lyell, Nymphalidae), moths (*Agrotis in-*

fusa (Boisd.) and *Caradrina cryphaea* Turner, Noctuidae) plus unidentified flies and wasps were attracted to the flowers. In addition, Ashton also noticed that bees (predominantly the introduced species), were the dominant vector during the day in sunny weather, while at dusk, noctuid moths became active and the Bogong Moth, *Agrotis infusa* (Boisd.) was particularly abundant. Unfortunately, no data was provided on pollen loads nor the comparative efficiency of the vectors in pollinating flowers.

Ashton (1975) also stated that it was likely that nectar-feeding birds were also important pollinators of *E. regnans* and lists (p.404) four species of honeyeater which were encountered during a heavy-flowering period in a mature forest of *E. regnans*. No birds were observed feeding from *A. woodsiana* at Burbank, although the possibility of parrots and honeyeaters as vectors cannot be overlooked and must wait further observations.

Furthering the work on the phenology of *E. regnans*, Griffin (1980) noted the flowers were protandrous and a wide range of insects visited the flowers for pollen and nectar. He did not however, provide a list of these insects or state whether they carried *E. regnans* pollen or not. Griffin presumed these insects to be the major pollen vectors, since over several seasons of observation, nectar-feeding birds were rarely sighted on the trees. Griffin also noted that many of the insects were large relative to the size of individual flowers and would tend to work whole inflorescences causing frequent geitonogamous pollinations (i.e. pollination of a flower by pollen from another flower on the same plant). These observations are supported by my own observations on beetles on *A. woodsiana* (Table 2).

According to Faegri and Van der Pijl (1976) plants which possess the syndrome of cantharophily (i.e. beetle pollination), have all or most of the following floral features — (a) flowers with no special or definite shape and few visual attractions; they are generally flat, cylindric or shallow, bowl-shaped and easy of access, (b) flowers which are dull, greenish or cream, and have open, easily accessible attractants such as nectar and pollen, (c) flowers with a strong, fruity or aminoid odour, (d) flowers with exposed anthers and stigmata (i.e. above the level of the corolla or perianth) and (e) flowers with an epigynous ovary.

Angophora flowers possess all these characters and are thus ideally suited for beetle pollination. Indeed, the information presented in this paper and previously published data on *Eucalyptus* pollination suggests that beetles are important pollinators of *Angophora* and *Eucalyptus* species, although these are not the only pollinators.

Thus, despite having all features of cantharophily, *Angophora* and *Eucalyptus* cannot be called obligate cantharophiles, since other vectors are known. For instance, Hopper, Coates and Burbidge (1978) and Ford, Paton and Forde (1979) have shown that birds play a dominant role in the pollination of certain eucalypts.

It would be most interesting and useful to compare the vector array throughout the range of this species and to compare it with that of other *Angophora* species. However, such comparisons will have to wait until further studies on insect vectors are undertaken and published.

Acknowledgements

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Naturalist Review

"Across Mountain and Plain" Published by BAIRNSDALE FIELD NATURALISTS CLUB.

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The family of Keith Churchill Rogers went to live on the Black Mountain plateau at Wulgulmerang, 30 miles north of Buchan, in 1902. Keith was then aged 7. Life was still very much a pioneering one — Bairnsdale, the nearest town of any size, was a 2-day buggy drive away. Black Mountain station which the Rogers purchased, was originally owned by the O'Rourke family who came from the Monaro in the 1840's and established homesteads at Black Mountain and in the Suggan Buggan valley.

Keith grew up with a keen sensitive appreciation of this wonderful upland area. He rode extensively about the district and developed a considerable knowledge of its fauna, flora and geology. He was a foundation member of the Bairnsdale Field Naturalists Club and in 1953 joined the Field Naturalists Club of Victoria. A most gentle, courteous and thoughtful man, he was always willing and ready to help fellow naturalists visiting the locality and there are many people who warmly remember his unstinting support. Over the years his articles to "Clematis", the Bairnsdale Club's journal, the Latrobe Valley "Naturalist" and our "Victorian Naturalist" were read with great interest and when he died in April 1978 at the fine age of 82, there were many who felt a deep sense of loss.

The Bairnsdale Field Naturalists Club is indeed to be congratulated. As a memorial to Keith and a splendid means of ensuring that his knowledge of North East Gippsland is handed on, that Club has published this valuable little anthology of his writings. The fine foreword by Dr Jim Willis expresses exactly what all of Keith's friends knew him to be.

The topics covered range widely — rediscovery of Rock wallaby, rare plants of the Nunniong Plateau, bird notes, mountain trips, plant lists of specific areas and many other subjects — and all written in Keith's simple, pleasant, very readable style.

This grand little publication will surely find its way to the book shelves of all naturalists but certainly those folk with a special place in their hearts for East Gippsland.

Gwynnyth Taylor.

Selection of a Neotype for the Southern Short-nosed (Brown) Bandicoot, *Isoodon obesulus* (Shaw & Nodder, 1797).

BY JOAN M. DIXON*

Historical background

The short-nosed bandicoot *Isoodon obesulus* was described as the Porculine Opossum *Didelphis obesula* by Shaw and Nodder (1797). The type specimen was preserved whole and the figure depicting it said to be of natural size. (Fig. 1) It measures 11.5 cm from the nose to the base of the tail in a straight line, and gives all appearance of being a juvenile animal. The specimen is attributed to John White (1757/8-1832), Chief Surgeon to the Settlement at Botany Bay who had an interest in natural history, collected specimens and produced drawings, some of which he published in a *Journal of a Voyage to New South Wales* (1790). The Porculine Opossum does not appear in any of his publications, but Shaw and Nodder recognised White as the source of the type specimen. Furthermore White presented the specimen to the anatomist and surgeon John Hunter (1728-1793). Subsequently, it was lodged in the British Museum.

In the Appendix to White's Journal p.269 are the comments "The Nondescript Animals of New South Wales occupied a great deal of Mr White's attention, and he preserved several specimens of them in spirits, which arrived in England in a very perfect state. There was no person to whom these could be given with so much propriety as Mr Hunter . . ." White arrived with the First Fleet in 1788 and remained in New South Wales until December, 1794. By the latter date, parties from the Port Jackson and Rose Hill (Parramatta) Settlement had crossed and explored beyond the Hawkesbury and Nepean Rivers. The precise locality for the type of *Isoodon obesulus* cannot be established, but the history of settlement and exploration of Australia during the period 1788 to 1797 strongly suggests that the specimen is from the Sydney area. However, on this line of evidence, the possibility that it came from the northern environs of the Hawkesbury River on the western environs of the Nepean River cannot be discounted.

Although the animal figured by Shaw & Nodder in the original description is recognisable as a young short-nosed bandicoot from its stance, stout body, short tail and ears, syndactylous hind feet and pointed snout, it is according to Tate (1948) "one of their poorest illustrations". The teeth are not accurately drawn, although they are small and numerous. Unfortunately, neither the illustration nor the accompanying description enables the species to be absolutely determined.

Geoffroy obtained information from Parkinson and wrote in 1804 of the Porculine Opossum which he named *Perameles obesula* "Il y a long-temps que je connoissois, par le Naturalist Miscellany, la figure du *didelphis obesula*, mais c'étoit envain que je m'étois occupé à en déterminer les rapports; je n'étois mis sur la voie de cette recherche, ni par l'analogie, puisque cette espèce n'appartenoit à aucun de mes genres de l'ordre des marsupiaux, ni par la description de M. Shaw, puisqu'il n'en qualifie les dents que par l'épithète de nombreuses. J'eus toutefois le pressentiment que ce pouvoit être le type d'une nouvelle famille, et dans cette persuasion, sachant que l'*obesula* faisoit partie de la collection de Hunter, je m'adressai en Angleterre à l'habile naturaliste Parkinson pour en obtenir les renseignemens que je désirois; j'en

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recus pour réponse la peinture que j'ai fait graver pour accompagner ce mémoire."

The sketch of *Isoodon* in Geoffroy (1804) was illustrated by Sydenham Edwards (1768-1819), botanical and zoological artist and editor of the New Botanic Garden. It is according to the author "de grandeur naturelle". The skull is larger than natural size. Geoffroy (1804) commented "Je rapporte avec doute à cette espèce un individu de la collection de Muséum, et qui nous vient aussi de la Nouvelle-Hollande. Il m'est parvenu dans un mauvais état de conservation, manquant de queue et de quelques doigts; il surpasse de plus du double la taille de l'*obesula*, il lui ressemble au surplus par ses oreilles arrondies, son museau court et les couleurs du poil qui tirent cependant un peu plus sur le brun; sa tête n'est pas non plus aussi arquée.

J'en fait graver le crâne, pl. 45 pour qu'on puisse le comparer avec celui de *nasuta*". The skull featured by Geoffroy did not belong to the type specimen but its features compare favourably with those of *Isoodon obesulus*.

Desmarest (1817) discussed the genus *Isoodon* and presented some information on the history of the species. He said that the name *Isoodon* had been used by Geoffroy in his public lecture on Zoology to the Museum d'Histoire naturelle de Paris, July 1817 and that Geoffroy (1817) gave an incorrect dental formula for the species ". . . en tout, cinquante dents." This seems to be Desmarest's interpretation and not Geoffroy's as Plate 45 of Geoffroy's 1804 work shows a typical *Isoodon* skull having a dental count of 48 and on p. 61 of that article Geoffroy mentions only 48 teeth. Desmarest's (1817) publication notes that the type was part of Hunter's collection, and that Shaw when describing it did not comment on the number and form of the teeth. According to Desmarest (1817) "Ce caractère important a été observé sur l'individu même de

Fig. 1. *Didelphis obesula*, the Porculine Opossum, from Shaw & Nodder (1797) Photo: R. Start.

Hunter, par M. de Blainville, dans le dernier voyage qu'il fait à Londres, et communique à M. Geoffroy qui en a tiré le nom du genre nouveau qu'il forme de cet animal". I am unable to locate any information which either indicates that Geoffroy did obtain such details from de Blainville or that his public lecture on Zoology was published. The true dental count is established from the skull featured by Geoffroy (1804) and discussed above. The type was listed as part of the British Museum (Natural History) collection by Gray (1843) as specimen "a. Very young. In spirits. The spec. figured by Shaw".

Waterhouse (1846) reviewed existing information on *Perameles obesula*. He examined the original specimen "described by Shaw, and feel no doubt that it is a young individual of the present species. I may add, that the skull figured by Geoffroy in the Annales du Muséum, and supposed to belong to the same species, is decidedly that of *P. obesula*." He did not mention the location of the Shaw specimen.

There is no mention of the type or the species in Gray's (1847) List of the osteological specimens in the collection of the British Museum. According to Thomas (1888), the type of *Isoodon obesulus* was "not in existence".

The validity of the animal in the original description being a short-nosed bandicoot is not disputed. Although the teeth are not shown with any accuracy, and there is no skull description, the animal agrees in both sketch and description with the currently recognised *Isoodon obesulus.* Present investigations indicate that this species has its northern limit at the Hawkesbury River, where it is replaced by the northern short-nosed bandicoot *Isoodon macrourus* (vide Dixon, 1978). It seems most likely that the type was *I. obesulus* and not the northern form *I. macrourus,* but as the locality cannot be precisely established, it is possible that the Shaw specimen was an example of the latter. Following examination of the collections of the British Museum (Natural History) and general enquiries which I have made about the possible location of Shaw's type, I consider that it no longer exists.

From my review of the genus (in ms.) I have decided that neotype selection for *Isoodon obesulus* is advisable because of the possibility that the specimen described by Shaw and Nodder is a specimen of *Isoodon macrourus* (Gould, 1842). An account of the taxonomy of the genus *Isoodon* based on cranial characteristics was presented at the 2nd International Theriological Congress, Brno 1978 by the author (Dixon 1978a).

Neotype Selection

Short-nosed bandicoots have not been recorded in large numbers from the Sydney environs in recent years. A single damaged and long collected (1888) specimen from Botany Swamps is held in the Australian Museum Sydney, No. A 264. Another specimen, a skull which is badly fragmented, collected from Milton south of Sydney in 1912 is held in the Smithsonian Institution Washington (Dixon, 1978). Neither specimen is suitable as a neotype.

Location

Specimens have been recorded recently from Ku-ring-gai Chase National Park, north of the Sydney metropolitan area, and a neotype has been selected from this region. On 18 September 1977, a young male *Isoodon obesulus* was captured by Mr A.B. Rose at a point 1.5 km south of the Hawkesbury River, 7.5 km from the Coal and Candle Creek Road turnoff on the West Head Road, Ku-ring-gai Chase National Park, north of Sydney, New South Wales, Lat. 33° 36′S; Long. 151° 16′E.

This specimen is registered as M11821

Fig. 2. Habitat of the neotype of *Isoodon obesulus*, West Head Rd. Ku-ring-gai Chase National Park, north of Sydney N.S.W. October 1977. Photo: A.B. Rose.

in the collections of the Australian Museum, Sydney, New South Wales. It is selected here as the neotype of *Isoodon obesulus* (Shaw and Nodder, 1797).

Habitat

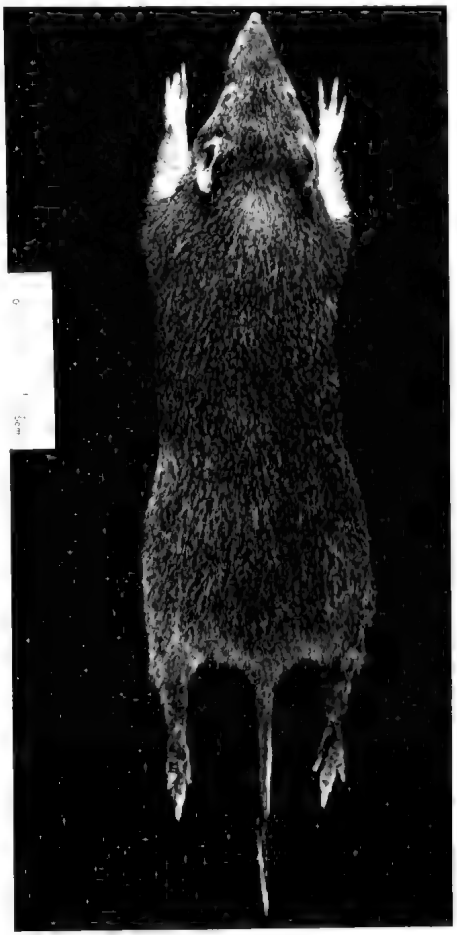
The underlying rock of the area is Hawkesbury Sandstone. The vegetation comprised *Eucalyptus haemastoma* to a height of 6 m, a tall shrub layer consisting of *Banksia ericifolia, Hakea sericea* and *Persoonia lanceolata* to 3 m, thickly growing smaller shrubs *Epacris microphylla, Boronia pinnata, Grevillea sericea,* and *Bossiaea scolopendria* which prevented low herb growth, and the ground covered with dead leaves. (Fig. 2.)

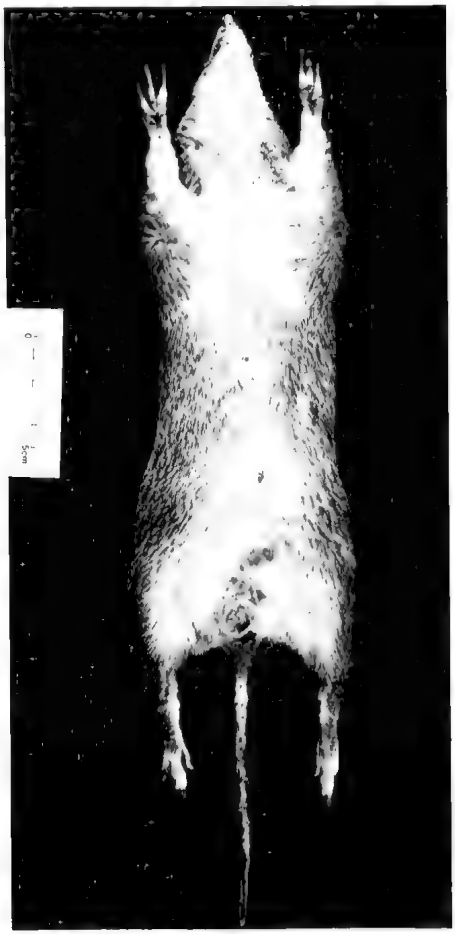
The specimen

The young male was trapped in a wire mesh cage trap, 36 cm long x 20.5 cm wide x 16.5 cm deep, using a bait mixture of peanut butter, oatmeal and honey. Its body weight when freshly killed was 524 g. Body measurements are as follows: Total length 375 mm, tail length 112.3 mm, pes (without claw) 55.5 mm, ear 31.45 mm. The specimen was deep frozen after death, prior to

Figs. 3-4 Skin of neotype of *Isoodon obesulus* M11821, Australian Museum, Sydney.

Fig. 3. Dorsal aspect. Photos: Figs. 3-9 R. Start. Fig. 4. Ventral aspect.





preparation as a study skin and skull at the National Museum of Victoria. The remaining skeleton and soft parts have been fixed in 10% formalin and preserved in 70% alcohol. One ectoparasite, a flea, was collected from the specimen and preserved with the specimen in 70% alcohol.

Description of neotype

The specimen agrees with currently accepted descriptions of the species. Its sturdy body is covered with a short, spiny coat, grizzled brown in appearance due to the black-based, yellow-tipped guard hairs. Fore-feet are pale on the inner and upper surfaces, while the outer surface is darker. Hind feet are pale on the inner side and golden-brown above. The under side is a yellowish-white. The snout is elongated and has a naked rhinarium. Ears are short and rounded, just reaching the eyes when pressed forwards. The tips are covered inside with yellow-brown hairs and outside with fine, darker hairs. The tail is short with a dark upper and pale under surface. The five-toed manus has reduced 1st and 5th digits. The others are well developed and clawed. In the hind foot the 1st digit is small and lacks a claw, the 2nd and 3rd digits are syndactylous and clawed, the 4th and 5th well developed and clawed. (Figs. 3, 4).

The skull is typical of *Isoodon obesulus*. Dental formula is

$$I\frac{5}{3}, C\frac{1}{1}, Pm\frac{3}{3}, M\frac{4}{4}.$$

Figs. 5-9. Skull of neotype of *Isoodon obesulus* M11821, Natural size.

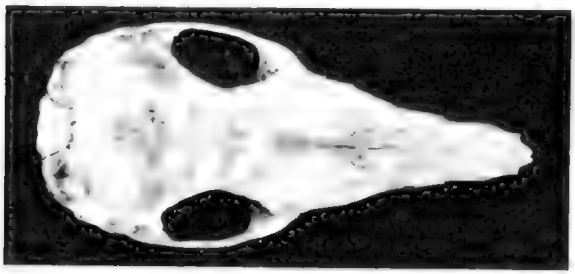


Fig. 5. Cranium — dorsal aspect.

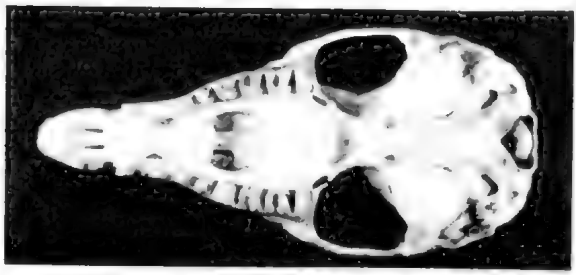


Fig. 6. Cranium — ventral aspect.

Fig. 7. Cranium — lateral aspect.

Fig. 8 Mandible — Lateral aspect.

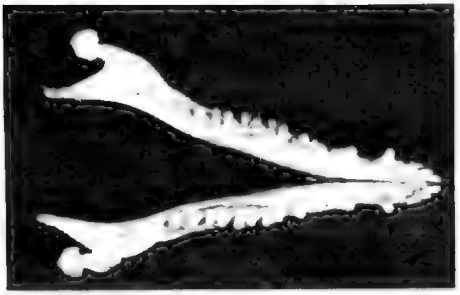


Fig. 9. Mandibles — from above.

The skull (Figs. 5-9) shows features of *Isoodon obesulus* recognised by Tate (1948). There are conspicuous accessory palatal vacuities between the anterior premolars, the bullae are inflated, the posteriorly projecting metacone on the upper M4 characteristic in *I. macrourus* is absent. The dentition is fully erupted and unworn except for the second premolar which is damaged at the crown on both upper and lower jaws.

The following skull measurements made on the neotype follow Thomas (1888) and Tate (1948):

Basal length	56.2 mm
Zygomatic breadth	27.9 mm
Length of nasals	25.4 mm
Breadth of nasals	5.6 mm
Intertemporal breadth	12.7 mm
Palatal length	36.4 mm
Breadth across M3	18.2 mm
Basi-cranial axis	18.5 mm
Basi-facial axis	38.2 mm
Length of upper molar row	12.4mm

Acknowledgements

Thanks are extended to Mr A.B. Rose who collected the specimen on which the neotype description is based, and to Mr J.A. Mahoney, Department of Geology and Geophysics, University of Sydney, for advice and criticism of the manuscript.

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The Origin of Generic Names of the Victorian Flora

Part 3 — Latin, Greek and Miscellaneous

(Continued from page 84, Vol. 98 No. 2.)

By James A. Baines

***Verbesina.** New Lat. verbesina, like *Verbena*, from the resemblance of the leaves to those of that plant. **V. encelioides*, Crownbeard or Goldweed, was placed in *Ximenesia* by Cavanilles in 1793 (in honour of a Spanish botanist, Ximenes), but transferred by U.S. botanist Asa Gray in 1876 (it is an American composite genus of 150 species). The specific epithet means 'like *Encelia*', another American composite genus, named after Christopher Encel, a writer on oak-galls.

***Vicia.** The Lat. name for vetch, which is an English form of the same word. Victoria has 6 naturalized species, all known as different kinds of vetch, including **V. sativa*, Common Vetch. The genus is papilionaceous.

Viminaria. Lat. vimen (genitive viminis), a twig, an osier; because of the long twiggy apparently leafless branches. *V. juncea*, Golden Spray, was named from its resemblance to reeds; its former specific epithet, *denudata*, from its denuded stems, and the common name from its showy pea-flowers.

***Vinca.** Shortened from Lat. vinca-pervinca, periwinkle (per, through; vincio, bind; for a twining plant). The English word has come from pervinca, and has also been given to the shellfish periwinkle, which should be merely winkle. Our species is **V. major*, Blue Periwinkle (from which as children we used to extract the little 'paint-brush'). It is in family Apocynaceae.

Viola. Lat. name for the violet and other sweet-scented flowers. Victoria has 2 introduced species, **V. odorata*, Common or Scented Violet, and **V. tricolor*, Wild Pansy, and 4 native, including *V. hederacea*, Ivy-leaf Violet, and *V. betonicifolia*, Showy Violet, the former specific epithet recalling *Hedera*, Ivy, and the latter *Betonica*, Betony. The genus gives its name to family Violaceae. The accent should fall on the first syllable, as in violet, not as in the musical instrument, the viola, whose derivation is different.

Viscum. Lat. name for mistletoe. *Korthalsella japonica*, Jointed Mistletoe, was placed by Thunberg (of 'Flora Japonica' fame) in this genus, which gives its name to family Viscaceae. It is native here as well as in Japan.

(cont. from p. 137)

Dr Smith ended on snails and showed a slide of Australia's largest snail with shell about 3.5cm long (1½"), our only slug, and the Lake Pedder snail with a magnified view of its teeth (radula).

Exhibits. A most impressive display was an entire benchful of newly bound journals for our library. They are the journals we receive each month but, for years, nothing has been done about binding. Mr McInnes took the matter in hand and now they're up-to-date. The money comes from the Club Improvement Account which is largely funded by the bookstall.

Three exhibits under low-power microscopes showed the 8mm (¼") larva of the Brown Lacewing and some aphids on which it feeds; very hairy 4mm larva of a beetle (some sort of carpet beetle?) and the eggs of a Sawfly. The eggs had been laid in a line inside a leaf, and the exhibitor split down one face of the leaf to reveal the eggs — each egg about 3mm long and all packed in a row side by side so that they looked rather like teeth.

Field Naturalists Club of Victoria
Report of recent Club activities

(cont. from p. 138)

limestone containing foraminifera *(Lepidocyclina)* with a piece under a microscope; this rock is used in law Court buildings at corner of Russell and Latrobe Streets.

A member reported finding part of a pelvis of diprotodon (fossil wombat to 6m long) at Fyannsford. Another reported the late Mr Arthur Swaby using a solution of *Bursaria spinosa* for protection against sunburn and a scientific test of it. Queensland Fruit Bats (about 70-80) are at present in the Melbourne Botanic Gardens.

Annual General Meeting
Monday 11 May

Annual Report for 1980 was read by President Dr Brian Smith. The main points were:

FNCV Centenary Year included such highlights as the Nature Show in October at the Lower Melbourne Town Hall, the week excursion at Wilsons Promontory in November, all day symposium at Rusden in July on effects of introduced plants and animals, and was capped by receiving the 1980 Victorian Conservation Prize.

The year began without a Club treasurer but Mr David Dunn was later appointed.

Several representations regarding conservation were made to government and other bodies.

Excursions, Special Study Trips and Group excursions continued.

The Victorian Naturalist included a special Centenary issue in June.

The bookstall run by Mr Dan McInnes continued to provide cheaper books for members and revenue for the Club.

1980 Australian Natural History Medallion was presented to Mr Michael Tyler of South Australia.

Treasurer's Report for 1980. Financial pages were printed in April issue 1981.

In absence of the Treasurer, former Treasurer Mr Dan McInnes reported a surplus of $60 for the year. There were sundry extra expenses due to Centenary activities, cost of the Natural History Medallion has increased, cost of printing the Victorian Naturalist has again risen and it alone exceeds subscriptions by more than $800! However, interest from investments, a grant from Victorian Government and from the Ingram Trust, have enabled all accounts to be met. The Club is in a sound financial position.

Election of Officers and Council Members. Officers elected: President Miss Wendy Clark, Vice-President Mr Jon Martindale, Treasurer Mr David Dunn, Assistant Treasurer Miss Lindy Lumsden, Excursion Secretary Miss Marie Allender, Editor Mr Rob Wallis, Assistant Editor Dr Dane Panetta, Librarian Mr Peter Kelly, Assistant Librarian Miss Madge Lester. Offices vacant: Secretary, Assistant Secretary, Programme Secretary.

Council members elected: M. Allender, D. Dunn, M. Lester, L. Lumsden, J. Martindale, A. Thies, H. Weatherhead. Council consists of the President (W. Clark), Vice-President (B. Smith) and then other persons, so we need three more Council members.

Speaker for the evening was retiring President Dr Brian Smith. Dr Smith game an illustrated talk on the National Museum and its three main functions — collecting, research and education by display of specimens.

Collecting, filing and preserving specimens is a continuing task since establishment of the Museum in 1854. Skeletons, skins and soft parts of creatures need to be available for researchers, and there are hundreds of microscope slides. Research is also carried out in the field and Dr Smith spoke of some of these activities including the recent biological survey before construction of Dartmouth Dam and the current survey of Thomson River. (cont. on p.136)

Field Naturalists Club of Victoria

Reports of recent Club activities

General Meeting
Monday 16 March

Mr Robert Burn spoke about Victorian opisthobranch molluscs — sea slugs to the layman. Although they may be described as sea snails without shells, "slug" seems a misleading derogatory term for such fantastic creatures.

Mr Burn said that there is still much to be discovered about Australian sea slugs and their distribution. He began by showing colour slides of some bubble shells where the shells were visible in the all-enveloping colourful mantle, and the gills being hidden by the mantle. Then he moved on to the tree nudibranchs that have no shells and the gills exposed on the back — sometimes in flower-like rosettes. The colours and combination of colours (reds, blues, orange, yellow) and the variety of form (with bumps and curious processes) were amazing and one imagined that such things would be confined to the tropics. But these were all Victorians and ranged in size from 2 or 3mm to more than 30cm.

When thanking the speaker, the President said that Mr Burn was an example of how a non-professional can add to our scientific knowledge. Mr Burn is an amateur but his spare-time activities have made him a recognised authority on Australian sea slugs and he has discovered several species new to Victorian waters.

Exhibits included the eggs and larvae of a paropsis beetle, young casemoth caterpillar about 2cm long (¾"), egg mass of the whelk *Thais orbita*, dead young butcher bird picked up in a garden, dishes of green algae *Nitella*, *Spirogyra* and *Cladophora*, and pond life under a microscope including rotifers, dino-flagellates and trachelomonas.

(cont. on p. 137)

General Meeting
Monday 13 April

The meeting stood in silence for a minute in respect for honorary member Miss Lorna Banfield who died last month.

Otway Ranges was the subject for the evening and there were two speakers.

Mr Graham Love spoke of the geology of the Ranges, the coastal plains to the west and the basalt plains to the north, showing several diagrams and cross sections. The cretaceous sedimentary strata of the Ranges has economic potential.

Mr Ken Norris of the Environment Studies Division of the Ministry for Conservation spoke of mammals of Otway Forest, a small fairly wet forest of Mountain Ash isolated from other forests. Mr Norris showed colour slides of its animals beginning with tree-top dwellers such as Long-eared Bat, Possums and Gliders, and moved progressively down to ground dwellers such as Red-necked Wallaby, Potoroo, Antechinus, Bush Rat, etc. The Otway Ranges is one of three places in Victoria where the Tiger Cat occurs, also the rare Smoky Mouse and Broad-toothed Rat. The 20-30 slides revealed some creatures unfamiliar to most of us even by name.

Exhibits and Nature Notes. A dark grey slug with black spots, about 5cm long by more than a cm diameter (2½" x ½") was found on silverbeet; it is the introduced *Limax maximus* and was carrying minute white mites. A squarish red lumpy object about 2½cm across (1") was the fruit cap of *Eucalyptus erythrocorys* of W.A. Piece of slate from Bendigo included iron pyrites (fools gold). Some gypsum selenite crystals came from Fossil Beach Mornington, and a swallow-tail form and a rosette from Fyannsford Quarry Geelong. Also from Fyannsford, some

GROUP MEETINGS

All FNCV members are invited to attend any Group meetings, no extra charge.

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

Second Thursday — Botany Group

Thursday, 9 July. Speaker: Mrs Ilma Dunn. Slides of New Zealand.

Thursday, 13 August. Speaker: Mrs M. Corrick. Victoria's deserts.

Third Wednesday — Microscopy Group.

Wednesday, 15 July. Protozoa. Speaker: Dr Peters.

Wednesday, 19 August. Diatoms. Speaker: Dr Blaze.

At the Conference Room, the Museum, Melbourne, at 8.00 p.m.

Good parking — enter from Latrobe St.

First Monday — Marine Biology and Entomology Group.

Monday, 6 July. Hydrozoa. Speaker: Mr D. McInnes.

Monday, 3 August. What plant does that insect feed on? Speaker: P. Carwardine.

GROUP EXCURSIONS

All FNCV members are invited to attend Group excursions.

Botany Group — last Saturday.

Saturday, 25 July. Mornington Peninsula — heathlands.

Saturday, 29 August. Botanic Gardens Annexe and Cranbourne area.

Saturday, 26 September. Starlings Gap mosses etc. Speaker: Arthur Theis.

Day Group — Third Thursday.

Wednesday, 15 July. Planetarium. Meet outside State Library (Swanston St entrance) at 11.30 a.m. *Please note change of day.* Leader: K. Gill (836 8016).

Thursday, 20 August. Zoological Gardens — bird aviary. Meet outside Royal Park station entrance at 11.30 a.m. Leader: D. McInnes (211 2427).

JUNE

Mon 1.	Marine Biology & Entomology Group. Insects. Some interesting life histories. Mr P. Kelly.
Tue 2.	Mammal Survey Group. Identification of Rodents.
Wed 3.	Geology Group.
QUEEN'S BIRTHDAY	
6-7-8	Mammal Survey. Mt. Worth.
Sun 7.	General Excursion Zoological Gardens, Parkville.
Thur 11.	Botany Group. Philippines Fungi. Mr M. McBain.
Mon 15.	General Meeting. Film Night. South West Tasmania.
Wed 17.	Microscopical Group. Rotifers. Mr P. Genery.
Thur 18.	Day Group — Arts Centre.
Sat 27.	Botany Group Excursion.

Erratum. The genus of the Blue Whale (Vol. 98, No.2 p.52) is *Balaenoptera* and not *Baelonoptera.*

Field Naturalists Club of Victoria

Established 1880

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 Honorable SIR HENRY WINNEKE, KCMG, KCVO, OBE, KStJ, QC.

Key Office-Bearers 1981-1982

President:
Miss WENDY CLARK, 27 Rangeview Grove, North Balwyn, 3104 (859 8091 A.H.)

Secretary:
Correspondence to: FNCV, National Herbarium, The Domain, South Yarra, 3141

Treasurer: Mr. D. DUNN, 3 Allfrey Street, East Brighton, 3187 (578 5753)

Subscription-Secretary: Miss H. MALCOLM C/- National Herbarium, The Domain, South Yarra, 3141

Editor: Mr. R. WALLIS, C/- State College of Victoria — Rusden, Blackburn Road, North Clayton, 3168, 544 8544.

Librarian: Mr. P. KELLY, C/- National Herbarium, The Domain, South Yarra, 3141

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

Group Secretaries

Botany: Mr. MICHAEL McBAIN, 19 Foster St, St Kilda, 3182 (534 2293)

Day Group: C/- National Herbarium, The Domain, South Yarra, 3141.

Geology: Mr. T. SAULT, C/- National Herbarium, The Domain, South Yarra, 3141

Mammal Survey: Mr. A. FAITHFUL, 67 Athelstan Road, Camberwell, 3124 (29 5108 A.H.)

Microscopical: Mr. M. H. MEYER, 36 Milroy Street, East Brighton (596 3268)

Entomology and Marine Biology: Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

FNCV Kinglake Nature Reserve: McMahons Road, Kinglake.

Bookings and keys: Mr. I. F. MORRISON, 788 Elgar Road, Doncaster (848 1194).

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 1981

Metropolitan	$12.00
Joint Metropolitan	$14.50
Country Members and Retired Persons	$10.00
Joint Country and Joint Retired	$12.00
Junior	$2.50
Subscription to Victorian Naturalist	$10.00
Overseas Subscription to Victorian Naturalist	$12.00
Individual Journals	$1.75

All subscriptions should be made payable to the Field Naturalist Club of Victoria and posted to the Subscription Secretary.

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The Victorian Naturalist

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1981

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$1.75

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FNCV DIARY OF COMING EVENTS

GENERAL MEETINGS

At the National Herbarium, the Domain, South Yarra.

Monday, 10 August, 8.00 p.m.

Life History of squids. Speaker: Dr C. C. Lu.

Monday, 8 September, 8.00 p.m.

Meeting sponsored by the Botany Group.

Mr R. Dodds will be awarded Honourary Membership.

Monday, 12 October, 8.00 p.m.

Aspects of the environmental impact statement in relation to the East Gippsland woodchip industry. Speaker: Dr B. Smith.

New Members — July/August General Meetings.

Ordinary

Jane Bartlett, 750 Drummond St, Carlton North.
Glen Jameson, 56 Everard Drive, Warrandyte.
Brian Monaghan, Newman College, Parkville.
Margaret Thomas, 12 Bedford St, Box Hill.
Maureen Thomas, 12 Bedford St, Box Hill.
Margaret White, 8 Fairmont Ave, Camberwell.
Mrs G. Wright, 16/55 Hotham Place, East St Kilda.

Joint

David, Joel and Angela McKenzie, P.O. Box 27, Brunswick.
Wendy Rutherford, c/- 50 Glyndon Rd, Camberwell.

Country

Alan Gibb, RMB 1170, Milawa.
Brian Hawkeswood, 48 City Rd, Chippendale.

FNCV EXCURSIONS

Sunday, 9 August. Boneseed pulling at Studley Park.

Sunday, 6 September. Yarran Dheran and nearby Reserves. Leader: Mrs J. Zirkler. The coach will leave Batman Avenue at 9.30 a.m. Fare $6.00. Bring a picnic lunch.

Saturday, 19 — Sunday, 20 September. Weekend get-together of the VFNCA at Yea. Details of, the programme and accomodation are in the last Naturalist. The coach from Melbourne will leave Flinders St outside the Gas and Fuel building at 8.00 a.m. Bring picnic lunches for Saturday and Sunday. Payment should reach the Excursion Secretary by the September General meeting.

Sunday, 4 October. Maryborough, Cosstick Reserve. This will be led by a member of the Maryborough FNC whom we will meet at the Maryborough Post Office at 11.45 a.m. The coach will leave Batman Avenue as near 9.20 a.m. as possible. Fare $8.50. Bring 2 meals and wear a name tag.

Preliminary notices:

Friday, 16 October — Friday, 6 November. New Zealand, North Island. Full details may be obtained from the Excursion Secretary. Final payments should be made by Monday, 7 September.

Tuesday, 3 November. Club picnic to Chambers Rock. Leaders: Mr and Mrs D. Dunn. The coach will leave Batman Avenue at 9.30 a.m. Fare $6.00. Bring a picnic lunch.

Saturday, 16 — Friday, 22 January. Portland. Details of this excursion will appear in the next Naturalist. The cost will be $220 for the fare and DBB accomodation in a motel. A deposit of $20 should be paid to the Excursion Secretary when booking.

GROUP MEETINGS

FNCV members are invited to attend any Group meetings, no extra charge.

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

First Tuesday — Mammal Survey Group.

Tuesday, 1 September. Island populations. Speaker: Andrew Bennett.

Tuesday, 6 October. Bandicoots. Speaker: Peter Brown.

First Wednesday — Geology Group.

Wednesday, 7 October. Granites of Wilsons Promontory. Speaker: Gary Wallis.

Third Wednesday — Microscopy Group.

Wednesday, 16 September. Pollen grains. Speaker: Dr Blaze.

Wednesday, 21 October. Marine life under the microscope. Speaker: H. Bishop.

Second Thursday — Botany Group.

Thursday, 11 September. Members' night.

Thursday, 8 October. The family Rutaceae. Speaker: Mrs H. Weatherhead.

At the Conference Room, the Museum, Melbourne, at 8.00 p.m.

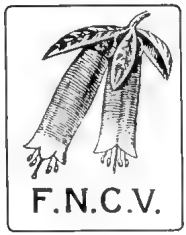
Good parking — enter from Latrobe St.

First Monday — Marine Biology and Entomology Group.

Monday, 7 September. Scale insects. Speaker: U. Bates.

Monday, 5 October. Insect pests and the Agriculture Department. Speaker: D. Harbeck.

Monday, 3 November. No meeting — Cup Day.



The Victorian Naturalist

Volume 98, Number 4 July/August, 1981

ISSN 0042-5184

Cover illustration: Walking down Merrit's Track, Thredbo. (See article on p. 170).

Blechnum vulcanicum Kukenthal (Blechnaceae): A new Record for Mainland Australia

BY N. G. WALSH*

The genus *Blechnum* L. contains about 180 species distributed throughout the world and is represented in Australia by some eighteen species which occur through a wide range of wet environments.

Features of the genus include linear sori which lie parallel and near to the midvein of the pinnae; indusia are attached toward the margin. Fronds are simply pinnate with the exception of *B. patersonii* (entire, lobed or pinnate), and luxuriant forms of *B. nudum* (pinnatifid).

Victorian Species

Nine species occur indigenously in Victoria, occupying wet sites from near sea-level to high-alpine bogs. Eight of the species are common where suitable habitats occur. The ninth, *B. vulcanicum*, has only recently been recorded for the Australian mainland and is otherwise widespread throughout the Pacific Islands (type locality Java), New Zealand and Tasmania where its habitat varies from dry woodland to wet-subalpine forest.

Description of *B. vulcanicum*

A tufted fern with erect rhizomes spreading by underground stolons. Stipes pale yellow-brown, to 20 cm., those of fertile fronds sometimes slightly more, invested toward the base with brown subulate scales and pronounced tubercles. Sterile fronds narrowly triangular to 30 cm. above stipes, simply pinnate; pinnae darkgreen, falcate, 2-8 cm. long, 0.5-1.0 cm. broad at base, attached to rachis by their full breadth except the lowest pair which are deflexed and attached by the upper half only, the lower half is free and produced into a rounded lobe; margins noticeably thickened. Fertile fronds similar but pinnae narrower, appr. 0.4 cm., sori continuous; indusium with irregular margins.

Habitat

Steep, sheltered rocky gully, sedimentary substrate. Altitude 1360 m.

Locality

Tributary of the Wonnangatta River, Snowy Range, Eastern Highlands, Victoria.

Similar Species in Victoria

B. aggregatum:

Distinguishable from *B. vulcanicum* by the reducing lower pinnae, i.e. frond broadest near centre of stipe c,f. *B. vulcanicum*, broadest at base. Basal scales generally not persisting.

B. cartilagineum:

Pinnae longer, not falcate; plant typically more robust (to 80 cm. tall); fertile pinnae not narrower than sterile pinnae. Basal scales generally not persisting.

B. nudum:

As for *B. aggregatum*. Fronds not falcate, rachis generally black.

Acknowledgements

Thanks to Betty Duncan and Prof. C. Chambers (Melb Univ.) for confirmation of specimen, to Dr J. H. Ross for advice and Anita Podzywynski for the careful and accurate illustration.

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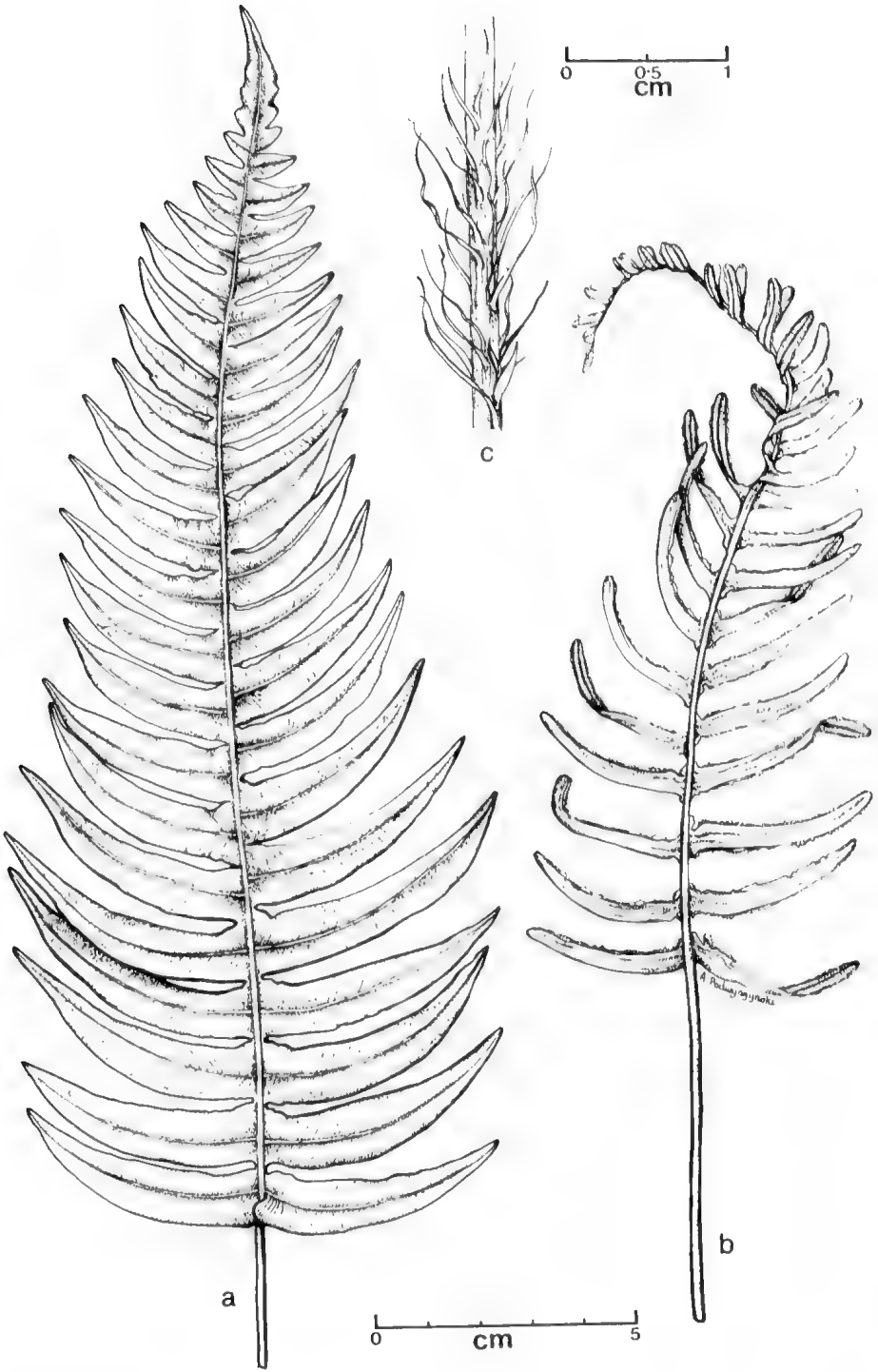
Specimen lodged at National Herbarium. Sth. Yarra. NGW no. 411.

*38 Paxton St., E. Malvern.

Fig. 1: Fronds and stipe of *B. vulcanicum*
a. Vegetative frond X1 Note overlapping lobes at base of lowest pair of pinnae
b. Fertile frond X1
c. Base of stipe bearing long, subulate scales X3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Observations On Two Sympatric Species of Buprestidae (Coleoptera) From Sand Dunes on the North Coast of New South Wales.

BY T. J. HAWKESWOOD*

Abstract

Three species of jewel beetle, *Agrilus australasiae* Laporte & Gory, *Cisseis scabrosula* Kerremans and an unidentified *Cisseis* species, were collected from leaves of *Acacia sophorae* (Labill.) R. Br. on foredunes near Coffs Harbour, New South Wales, during December, 1978. Observations on the behaviour, host plant specificity and predators of *A. australasiae* and *C. scabrosula* are recorded and discussed for the first time.

Introduction

The Buprestidae are a large family of beetles, well represented in Australia. About 800 species are presently known and many others await description. Despite the large number of species and the apparently widespread distribution of a few species, very little information is available at present on their exact distribution, plant preferences, behaviour and breeding biology.

However, there have recently appeared a number of papers which have greatly increased our knowledge of the Australian buprestid fauna. Barker (1975, 1977) has revised *Astraeus* and provided a checklist of *Stigmodera (Castiarina)* (Barker, 1979). Williams (1977) and Hawkeswood (1978) have provided data on buprestids from areas around Sydney which are being threatened by urban development. Peterson and Hawkeswood (1980) have recently provided notes on the general biology of *Diadoxus* from Western Australia.

Further information on buprestid behaviour, distribution and food plants of two species of Australian Buprestidae is provided here for the first time.

* Department of Botany, James Cook University, Townsville, Queensland, 4811.

Observations

On the 11 December 1978, a visit was made to Hungry head, a beach approximately 21 km south of Coffs Harbour, north-east New South Wales (30°31'S, 153°02'E). A large number of individuals of *Cisseis scabrosula* Kerremans were collected from the leaves (or stems) of non-flowering *Acacia sophorae* (Labill.) R.Br. plants between 1020 and 1235 hrs (Eastern Standard Time). During the course of observations and collections of *C. scabrosula, Agrilus australasiae* Laporte & Gory and a further (unidentified) *Cisseis* species were also noticed in fewer numbers on *A. sophorae* stems and leaves.

During the course of observations, temperatures varied from 29-32°C and there was a slight sea breeze.

Selected plants of *A. sophorae* (growing along a 100m stretch of foredunes) were closely examined for a period of 5 minutes each, during which time, the number of males and females of *C. scabrosula* were recorded, as well as the number of pairs in copulation and the frequency of which escape mechanisms occurred (Table 1). In addition, similar observations were made on individuals of *A. australasiae.* Plants chosen for study were growing more than 3 metres apart to minimize counting individuals more than once which flew from one plant to an adjacent plant during the course of one observation period.

(A) Notes on escape behaviour

Hawkeswood (1978) observed three

Table 1. Observations on *Cisseis scabrosula* Kerremans from eight *Acacia sophorae* plants at Hungry Head, north-east New South Wales on 11 December, 1978.

Plant number	Number of beetles per plant (during obs. period)*			Number of pairs observed in copulation per plant	Number of times "upward flight" occurred (during each obs. period)*	Number of times "free-fall and flight" occurred (during each obs. period)*	Number of times thanatosis occurred (during each obs. period)*
	♂	♀	Total				
1	23	20	43	4	4	2	1
2	15	8	23	2	1	1	0
3	12	21	33	5	4	1	1
4	8	11	19	2	0	1	0
5	11	15	26	3	2	1	0
6	5	8	13	1	1	0	0
7	10	4	14	2	1	0	0
8	8	12	20	3	1	1	0
Totals	92	99	191	22	14	7	2
Averages (per plant)	11.5	12.4	23.9	2.75	1.75	0.88	0.25

* = Observation period = 5 minutes for each plant.

(Voucher collections of *C. scabrosula* are housed in the author's private collection).

Table 2. Observations on *Agrilus australasiae* Laporte & Gory from twelve plants of *Acacia sophorae* at Hungry Head, north-east New South Wales on 11 December, 1978.

Plant number	Total number of beetles per plant (during obs. period)*	Number of times "upward flight" occurred (during each obs. period)*	Number of times thanatosis occurred (during each obs. period)*
1	1	1	0
2	2	1	1
3	2	1	1
4	1	1	0
5†	3	1	1
6†	1	0	0
7†	2	1	0
8	2	1	1
9†	2	1	0
10	4	1	1
11	2	1	0
12	1	1	0
Totals	23	11	5
Averages (per plant)	1.9	0.9	0.4

* = Observation period = 5 minutes for each plant.

† = One voucher specimen was collected from each of these plants before observations on escape behaviour were undertaken.

(Voucher specimens are housed in the author's private collection).

escape mechanisms exhibited by adults of Australian Buprestidae. Briefly these are (a) "upward flight" — when disturbed, the beetle stops moving, quickly opens its elytra and flies upwards rapidly before flying in other directions, (b) "free-fall and flight" — the beetle usually falls a short distance from a stem, leaf or flower of the food plant and then flies away before hitting the ground, and (c) thanatosis or "free fall and death feign" — the beetle merely drops to the ground and there remains in an "inert" condition usually with the ventral surface facing upwards.

(i) *Cisseis scabrosula* Kerremans

This buprestid exhibited all three

escape mechanisms when approached or disturbed (Table 1). Of the 23 observations on escape behaviour, "upward flight" was the most frequent with 14 occurrences (i.e. 60.1% of the total), while 7 occurrences (30.1%) of "free-fall and flight" were observed and only 2 occurrences (9.8%) of thanatosis were recorded (Table 2). An additional behavioural trait to that previously recorded on *Cisseis* (Hawkeswood, 1978; and unpublished data) was noted on *C. scabrosula*. When approached to within about 30cm, some beetles ceased movement, reversed direction (so as to move down the *Acacia* stem) and then moved to the surface of the stem facing away from the predator (in this case the author). Beetles then proceeded down the stem for a distance of a few centimetres before flying away, or displaying the "free fall and flight" escape mechanism. Thanatosis was usually exhibited upon immediate danger i.e. when the author suddenly moved in to capture a resting beetle.

(ii) *Agrilus australasiae* Laporte & Gory

This species was present in much fewer numbers than *Cisseis scabrosula* (Table 2). A total of 16 occurrences of escape behaviour were recorded (Table 2). Of these, 11 occurrences (i.e. 68.8% of the total) of "upward flight" and 5 occurrences (31.2%) of thanatosis were recorded, while "free-fall and flight" was not observed (Table 2). Individuals of *A. australasiae* were more adept than those of *C. scabrosula*. No mating was observed in *A. australasiae*.

(iii) *Cisseis* sp.

Since all three specimens observed were also collected for voucher material, no observations on their behaviour were possible. This species will not be discussed until further collections and observations are made. It is mentioned here in the interest of it being a third sympatric species on *Acacia sophorae* at Hungry Head.

(B) Host plant specificity

All three buprestids appeared to be restricted to *Acacia sophorae*. Examination of other plants on the dune system (i.e. *Carpobrotus glaucescens* (Haw.) Schwartes (Aizoaceae), *Spinifex hirsutus* Labill. (Poaceae) and *Banksia integrifolia* L.f. (Proteaceae)), indicated that buprestids were not utilizing these as secondary food sources at the time, since no individuals were found on these plants. A few individuals of *C. scabrosula* were observed feeding on *A. sophorae* leaves and both buprestids fed readily on *A. sophorae* leaves in the laboratory (at the Botany Department, University of New England, Armidale). An examination of a small sample of *Acacia* plants in the field showed extensive leaf damage, probably due to feeding by these three buprestids, since no other phytophagous insects were observed on the foliage.

(C) Other behavioural observations

Not all *Acacia* plants were occupied by buprestids. Observations suggested that only 15-20% of the *Acacia* plants growing in the 100 metre tract of dune sampled were being utilized by the buprestids and these were all in the one area.

Cisseis scabrosula congregated on both sides of leaves and on stems towards the ends of branches. Mating readily occurred during these congregations, although no eggs were deposited. Of 191 *C. scabrosula* counted, 22 pairs (representing 23% of the total number counted, Table 1) were found in copulation. Copulation lasted 10-30 seconds. No mating between individuals of *Agrilus australasiae* was observed.

Between 4 and 11 individuals of *C. scabrosula* were present on leaves and stems (at any one period of time per plant), mostly at the ends of branches. The number of males and females present per plant was variable (Table 1), but overall, approximately equal numbers of males (92) and females (99) were

counted (Table 1). The occasional specimen of the unidentified *Cisseis* species was present amongst the groups of *C. scabrosula*. Individuals of *A. australasiae* tended to be absent from plants upon which *C. scabrosula* were common. The plants occupied by *A. australasiae* were usually smaller (0.3-0.4 metres high) than those commonly utilized by *C. scabrosula* which were 0.4-0.7 metres high.

(D) Predation by spiders

A spider, *Uloborus* sp. (Uloboridae), was resident amongst the *Acacia* foliage in few numbers. From a total of 35 webs examined on the foredune, only five (14.3%) were occupied by spiders. Their webs were thin and relatively weak, but examination of two adjacent webs showed that two small *C. scabrosula* (both males) had been captured. One beetle was dead and wrapped in silk while the other was unsuccessfully trying to escape from the web. The spider quickly pounced on the beetle, immobilized it by biting the muscular tissue between the thorax (pronotum) and elytra and began feeding on the beetle's fluids. The spider fed for about two minutes and then wrapped the dead beetle in silk.

Discussion

Since Kerremans (1898) described *Cisseis scabrosula*, almost nothing has been published since on the species. Carter (1929) lists its distribution as New South Wales and Victoria and includes it in his key to *Cisseis* (Carter, 1923).

Cisseis scabrosula is an alert and active insect and may exhibit several escape mechanisms when approached. Its tendency to move to the opposite side of *Acacia* stems when approached, is an addition to the patterns of escape behaviour previously noted in *Cisseis* by Hawkeswood (1978). Linsley and Ross (1976) note that the buprestid *Hippomelas sphenica* (Le Conte) from North America has the habit of moving to the opposite side of the branch when disturbed. However, these authors do not mention whether any further escape behaviour occurred after the beetles had moved.

Rapid movement to the other side of a branch when approached may enable beetles to become obscured from a predator's sight. This behaviour may also permit beetles to adopt a cryptic position on the stems (especially near the base of the phyllodes). In the event of further danger from predators, rapid methods of departure would facilitate the insects' safety. At present, little is known about predators of Australian buprestids. It is likely that the escape mechanisms exhibited by *Cisseis* (and other genera) have played an important role in their survival and evolution.

The congregations of *C. scabrosula* on branch tips is probably related mainly to sexual activities, for it is here that mating commonly takes place. *C. scabrosula* also appears to prefer feeding and mating on larger plants of *A. sophorae*. These sites are fully exposed to sunlight and permit ready flight and escape, and probably give beetles better opportunities to detect moving predators.

There are very few reports of predation on Australian jewel beetles. Douglas (1954) reported the dusky wood swallow *(Artamus cyanopterus)* as a predator of an unidentified *Curis* species. Barker and Inns (1976) first recorded an asilid fly *(Phellus piliferus)* feeding on a large jewel beetle, *Stigmodera (Themognatha) tibialis* Waterhouse from Western Australia. Hawkeswood (1980) first recorded the spider *Araneus* sp. (Araneidae) as a predator of the small *Stigmodera (Castiarina) picta* Laporte & Gory near Gingin, Western Australia. That spiders do predate on buprestids, is further substantiated here.

Agrilus australasiae was described by Laporte and Gory (1837) and since then the only notes published on its biology are those by Froggatt (1902). He states:

"This is a plentiful species upon the foliage of this wattle [*Acacia decurrens* (Wendl.) Willd.] in the early summer in the Mittagong district (New South Wales; 34°27′S 150°27′E) where numbers can be taken by shaking the branches into a net or umbrella."
recorded (Table 1). An additional made to Hungry Head, a beach approx- least disturbance. Little is known about the biology of the Australian species of *Agrilus* but the data at hand suggests that they are specifically foliage feeders on *Acacia* leaves.

The three buprestid species appear to occupy a habitat which is restricted to a narrow zone on the sand dunes adjacent to the ocean. It is possible that *Acacia sophorae* is the only species which they utilize for food and breeding purposes in the Coffs Harbour area. Since they appear restricted to *Acacia* along the dunes, any future disturbance to this environment (e.g. clearing of the dunes for residential development, which is at present occurring to some extent) could lead to their extinction in these areas.

Acknowledgements

I would like to thank Dr J. D. O'Dea (Department of Physiology, University of New England, Armidale, N.S.W.) for critically examining earlier drafts of the manuscript. Thanks are also expressed to Messrs. D. Knowles and M. Peterson (Perth, W.A.) for reading and commenting on an earlier draft which was written in 1979. Lastly, I would like to thank Mr Bruce Murray (Bellingen, N.S.W.) for accompanying me to Hungry Head and Mylestom Beach and for assistance in field observations and collections.

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Observations on Some Jewel Beetles (Coleoptera:Buprestidae) From The Armidale District, North-eastern New South Wales.

BY T. J. HAWKESWOOD*

Introduction

The Buprestidae are commonly known as "jewel beetles" and they are most abundant in the tropics (e.g. Britton, 1970; Gray, 1974; Hawkeswood, 1980). Despite the large number of species in the family, which Britton (1970) has estimated to be about 15,000, little is known about their general biology, and in particular, adult behaviour, feeding and flight biology, and relative importance in the pollination of flowers. In Australia, despite it being regarded as one of the headquarters for the family (Tillyard, 1926) and having about 800 species (Carter, 1929; Britton, 1970), almost nothing is known about the distribution, ecology and life histories of buprestids, although taxonomic work is still proceeding (e.g. Barker, 1975; Levey, 1978). This is in contrast to the situation in other places such as the United States of America where ecological studies have been undertaken in conjunction with taxonomic work (e.g. Hespenheide, 1969; 1973; 1976; Nelson & Westcott, 1976; Westcott & Verity, 1977; Westcott *et al*, 1979). This situation has changed somewhat in Australia with the appearance of papers by Williams (1977), Hawkeswood (1978; 1980; 1981) and Peterson & Hawkeswood (1980).

Further observations and notes are provided on four sympatric species, *Stigmodera (Castiarina) inflata* Barker, *S. (C.) oblita* Carter, *Curis caloptera* (Boisduval) and *C. splendens* Macleay from the Armidale area, North-eastern New South Wales.

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Observations

On 22 February, 1978, a visit was made to Dangars Falls, some 24 km ESE of Armidale, North-eastern New South Wales (30°41¹S, 151°44¹E), during 1245-1350 hrs (Temp. 23°C-26°C). Numerous individuals of a black and yellow buprestid, *Stigmodera (Castiarina)* species were collected from five flowering bushes of *Bursaria spinosa* Cav. (Pittosporaceae) growing on the edge of a high cliff near the falls proper and in a creek bed near the top of the falls. Some of the beetles were soft indicating that they had recently emerged from pupae. This buprestid proved to be undescribed and was later named *Stigmodera (Castiarina) inflata* by Barker (1980) and is only known from the specimens collected by the author (and B. J. Hawkeswood) from Dangars and Bakers Creek Falls, in the Armidale district (Fig. 1). Another buprestid, *Curis splendens* Macleay (Fig. 2) was associated with *S. inflata* on *Bursaria spinosa* flowers, but in smaller numbers. No other buprestids were observed. Large numbers of flies, wasps and cockchafer beetles were also observed sharing the feeding niche on flowers of the *Bursaria*.

Visits to Dangars Falls were again made on 17 September, 1 October, 9, 16 November, 9, 25 December 1978, 14, 20 January and 8-14 February 1979, but *S. inflata* was only collected on 10-14 February 1979, during the peak flowering phase of *B. spinosa*. This buprestid appeared to be present in fewer numbers than at the same period the previous season. *Curis splendens* was also commonly present during the flowering of *B. spinosa*.

On 23 February, 1978, a visit was made to the Bakers Creek Falls lookout (30°35'S, 151°48'E) where large numbers of *S. inflata* were observed feeding and resting on *Bursaria spinosa* flowers. There was a slight breeze blowing, the weather was overcast and the temperature was 22°C during the course of observations (1320-1530 hrs, EST). *Stigmodera inflata* was the dominant insect species on the blossoms, and was present in much larger numbers than observed at Dangars Falls on 22 February, 1978. During the course of observations, *Curis splendens* Macleay, *Stigmodera (Castiarina) oblita* Carter and one specimen of *Curis caloptera* (Boisduval) were noticed on the flowers. *Bursaria spinosa* was growing in a comparatively large stand near and on the edge of a cliff in two semi-cleared paddocks with *Eucalyptus* species, *Jacksonia scoparia* R.Br., herbaceous annuals and various grasses. About 42 *Bursaria* plants were counted in the area, but only 18 (43.3%) were flowering. All these were examined and the numbers of *S. inflata* and *C. splendens* (the most common buprestids) were recorded (Table 1). In some cases, large bushes (1.0-1.5 m high) were at the stage of peak flowering and nectar production was high. Since these bushes offered abundant and easily accessible food, large numbers of nectar-feeding *S. inflata* were attracted to the blossoms (Table 1). Although accurate counts were unable to be made due to some beetles movements from place to place during counting and the large numbers present, an estimate has been made for these plants (i.e. plants 7, 8, 10, Table 1). Fortunately, in other instances, beetles were present in lower numbers, so that the counting of individuals more than once on a particular plant, was minimal. No beetles were found on poorly flowering or non-flowering plants (Table 1) (i.e. plants in these two categories were usually young plants < 1m high). Both buprestids *(S. inflata* and *C. splendens)* favoured the large, profuse flowering bushes (Table 1). Up to 8 beetles at a time were either feeding or resting on a panicle of flowers (i.e. a group of 20-40 flowers).

Table 1. Abundance of *S. inflata* Barker* and *Curis splendens* Macleay* on flowers of *Bursaria spinosa* Cav. at Bakers Creek Falls, north-east New South Wales on 23 February, 1978.

Plant No.	No. of buprestids		Plant No.	No. of buprestids	
	S. inflata	*C. splendens*		*S. inflata*	*C. splendens*
+ 1	0	0	10	c.75	5
2	18	2	11	15	2
3	10	1	12	22	3
4	19	2	13	4	0
5	8	0	14	12	.
6	12	2	15	1	0
7	c.90	8	+16	0	0
8	c.60	6	+17	0	0
9	5	0	18	22	.

Total: c. 360 *S. inflata*. Average/plant = c.20
34 *C. splendens*. Average/plant = c.2

* Voucher specimens of both species are housed in the South Australian Museum (SAM).

\+ Poorly flowering plant.

Fig. 1. *Stigmodera (Castiarina) inflata* on flowers of *Bursaria spinosa*, at Dangars Falls, North-east New South Wales, 22 Feb. 1978. Bar indicates 5 mm. (Photograph by B. J. Hawkeswood).

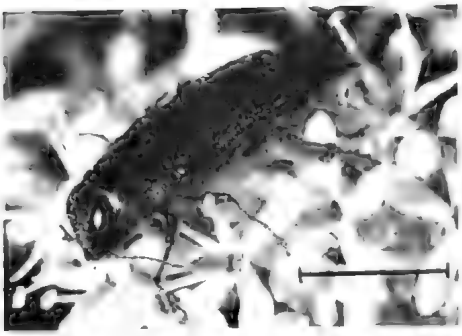

Fig. 2. *Curis splendens* on flowers of *Bursaria spinosa*, at Bakers Creek Falls, North-east New South Wales, 23 Feb. 1978. Bar indicates 5 mm. (Photograph by B. J. Hawkeswood).

The most interesting aspect of the behaviour of *S. inflata* was the distinct but dull whirring noise made in flight, presumably derived from beating the wings against the elytra (wing-cases) and/or body. This whirring sound resembled a large hive-bee in flight. Periods spent in flight were generally small (2-25 seconds). Beetles usually flew for short distances from one group of flowers to another on the same plant. Nearest-neighbour flights to adjacent plants also occasionally occurred. No escape mechanisms were displayed until the author gently shook a branch which induced only two beetles (from a total of 15 on the branch) to undergo thanatosis (i.e. "free-fall and death feign", see Hawkeswood, 1978).

The aggregative behaviour of *S. inflata* on blossoms of the foodplant, is typical of many other nectar-feeding species (Hawkeswood, 1975-80, pers. obs.). However, in this case, *S. inflata* was the only species dominant. This is in contrast to other areas, e.g. the Blue Mountains, N.S.W., where up to 15 species of Buprestidae may be found on the one foodplant, and a high percentage (c. 60%) may be common on blossoms (Hawkeswood, 1978). As mentioned previously, other insects, e.g. flies, wasps and cockchafers, were also common visitors to flowers at Dangars Falls, but at Bakers Creek Falls, only a small number of flies were noticed on blossoms. About 0.5 km further along the road leading to the highway to Armidale, five *Bursaria* plants were examined on the same day. Although no buprestids were observed, large numbers of flies, wasps, cockchafers and butterflies were present. Almost all populations of *B. spinosa* were examined for insect vectors during 1975-79 in the Armidale district. Only at Bakers Creek and Dangars Falls, were *S. inflata* found. It would appear then that populations of *S. inflata* at Bakers Creek Falls are very localized at present, and the large numbers of this buprestid on *Bursaria* flowers probably excludes most other insects from visiting flowers on these plants.

Stigmodera inflata possesses typical warning coloration i.e. yellow fasciae (bands) on a black background. It is possible that there is an evolutionary tendency for this species to mimic bees and/or banded wasps, both in colour pattern and sound. The predators of *S. inflata* in the Armidale area are unknown. Hawkeswood (1978) and Peterson and Hawkeswood (1980) have suggested that birds (e.g. magpies and butcherbirds) are the most likely predators of buprestids. If this is the case, then such aggregations of *S. inflata* feeding synchronously on *B. spinosa* (coupled with warning colora-

tion and mimicry) may be important in reducing predation pressures, and allow beetles better chances of finding partners for breeding purposes in order to maintain a large population size.

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I would like to thank my brother, Mr B. J. Hawkeswood, for assistance in field work. My research on the Buprestidae of Australia has been undertaken on private funds and I would like to thank my mother, Mrs D. E. Hawkeswood, for facilities provided during this time, 1975-81.

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Radiocarbon Dating of Estuarine Shells in the River Yarra, Royal Botanic Gardens, Melbourne, Victoria

BY EDMUND D. GILL*

Waterfall at Melbourne

The early history of Melbourne is the story of two rivers — the Saltwater River, now called the Maribyrnong, and the Freshwater River, now called the Yarra. Melbourne stands where it is because of the supply of fresh water. When the early settlers sailed up the Yarra they found it was shallow and salty for some distance, but further up it became fresh and deep. It widened into a pool nine metres deep, which came to be known as The Basin (Billot 1979). However, the boats could go no further because of a waterfall about a metre high consisting of basalt. Flood waters pouring over this waterfall had scoured out The Basin, which formed a natural harbour for the small boats in use then.

Upstream from the waterfall the basalt formed a rapids. Old photographs show basalt outcropping through the water. This lava flow is of olivine basalt about 810 000 years old (Bemmett et al., 1975). Billot (1979) described early Melbourne thus — "The tents of Hoddle and his surveyors nestled by the Yarra Falls, and clustered around what was later to be the Market Square stood the huts and tents in which the settlers lived".

Estuarine Bed above Waterfall

During the low sea level of the Last Glacial Period, Port Phillip was dry and the Yarra River flowed along its floor. Because of this lower base level, the Yarra cut far below its present level in the Melbourne area. Thus the stump of a red gum was found in living position 19.2 m below present low water when the Spencer Street bridge was being built (Gill 1971). When the sea rose again this channel was infilled. When the first settlers came to Melbourne, the Yarra was flowing over the basalt flow that created the waterfall.

North of the Yarra River the early settlers saw Batman's Swamp, and many of us can remember part of this in its natural condition, standing above high water level and crowded with shelly fossils. In the late 1940s and in the 1950s I monitored numerous bores in the Yarra Delta (including the Appleton Dock and Coode Island series) and noted a number of places where the in situ shell bed (not filling) extended above high water level. It is significant that, in spite of compaction, the top of the shell bed stands so high. The explanation is that sea level was higher some 6000 years ago, and Russell's map (Figure 1) shows the old sea cliff near Spencer Street. At that time the estuarine bed extended up the Maribyrnong River to the munition works (I collected shells from the mouth of Steele Creek), and up the Yarra River to beyond Swan Street, Richmond, where shelly beds are known. Beside the Maribyrnong River north of the Maribyrnong Road bridge I collected the skeleton of a porpoise, while at the bend in the river near the boatshed I found a shark's tooth in a sewerage excavation. Further upstream at Brunel Street I discovered in the estuarine shell bed a piece of red gum bored by marine borers that dated 4820 ± 200 years (W-170).

If the waterfall on the Yarra River (1 m high) was overtopped by the estuarine waters that deposited the shell bed, the sea would need to have been about 2 m above present level. The fact that under natural conditions the river flowed over the waterfall shows that the Pleistocene low level river channel had

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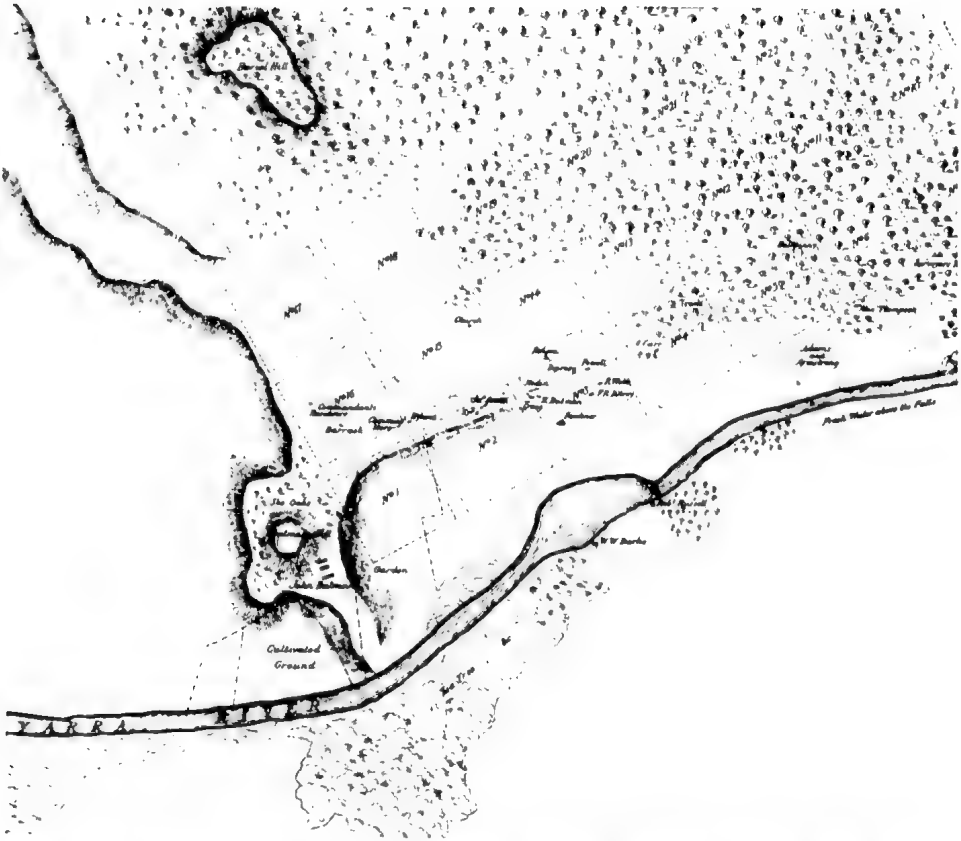

Fig. 1. Part of Robert Russell's 1837 map of Melbourne, showing The Basin opposite William Street, the waterfall, and the former cliff near Spencer Street. At the south end of the cliff is Batman's Hill, now the site of the Spencer Street railway station.

been filled in to a high level above that of the basalt. Diatoms also provide evidence of this incursion of the sea (Gill 1953).

Shells for Radiocarbon Dating

Melbourne's first bridge ran diagonally across the Yarra River a short distance upstream of the waterfall. The basalt provided an excellent foundation. On the other hand, it also provided a serious impediment to the movement of flood waters. The floods became a serious menace (see picture Gill 1971 frontispiece), so it was decided to remove the basalt and straighten the river course. Kitson (1900) has mapped the old and new courses, showing how a former bend in the Yarra has been incorporated in the present Royal Botanic Gardens. In Kitson's time the Friendly Society Gardens lay on the opposite bank of the Yarra from the "Botanical Gardens".

Kitson made his observations in 1898 during construction, and noted throughout the area an estuarine shell bed with nine species of pelecypods, four of gasteropods, and a barnacle. The fauna includes *Anadara trapezia* of which there are millions in the Yarra delta. This species is still in Port Phillip Bay, but at the limit of its distribution. The shell size there is small, and they grow below low water level only. One Saturday afternoon during the building

of Appleton Dock I took my young family there to collect *Anadara* for a biometrical study. In a short time 2000 shells were collected. I was impressed by their overall large size and thickness. It appears that the world climate was slightly warmer then, and the higher sea level may well be a result of that.

Radiocarbon Date

As no radiocarbon date had been obtained for the shell bed in the Yarra above the waterfall, I approached Dr Peter Jell of the National Museum of Victoria, who kindly made available some shells of *Polinices sordidus* collected at the time of the improvement works. The outside label read "Friendly Society Gardens" but inside the box another label read "Botanic Bridge". This bridge at Anderson Street is shown in Kitson's map, so I conclude that the shells were collected near the Royal Botanic Gardens at the north end of the Anderson Street bridge.

The New Zealand Radiocarbon Laboratory, through Mr T. Grant-Taylor, kindly assayed these shells. The old half life of C14 (as used for earlier dates) gives an age of 6780 ± 190 years B.P. (N.Z. 5094A) while the more recently calculated half life gives an age of 6980 ± 200 years B.P. (N.Z. 5094B).

Ecology of *Polinices sordidus*

This carnivorous gastropod lives in muddy sand at low tide in Port Phillip and Western Port. In does not survive in areas of restricted salinity. Kitson does not state at what level he found the shells, but it would be appreciably below that at which they lived because these muddy sediments suffer a high degree of compaction (Gill and Lang 1977).

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A Note on Climbing Ability in Tiger Snakes *(Notechis scutatus)* and Predation on Arboreal Nesting Birds

BY GARRY A. WEBB*

Australian elapid snakes have been reported preying on ground nesting birds (Anon, 1919; Cogger, 1979; Le Souf, 1911). To my knowledge there have been no published observations of elapid predation on arboreal nesting birds. Shine (pers. comm.) removed several nestling Magpies *(Gymnorhina tibicen)* from the stomach of a Tiger snake *(Notechis scutatus)* which was found in a hollow limb of a tree in the Armidale area.

Climbing ability in Tiger snakes has been documented previously (Heatwole *et al.*, 1973). They observed a 50 cm long Tiger snake climbing to a height of 10 metres in a large radiata pine *(Pinus radiata)*. Similarly, the observation reported here involves a Tiger snake climbing a Radiata Pine.

At 1800 hrs. on the 2nd January 1981, a Tiger snake approximately one metre in length was observed in a 15 cm diameter radiata pine in Bondi State Forest, N.S.W. The snake was tightly coiled around a whorl of branch stubs 1.6 metres above the ground (Figure 1A). In attempting to get a closer view I disturbed the snake which quickly descended, partially sliding (with its tail still anchored around the tree) and then falling once it relinquished its hold (Fig. 1B).

When the tree was inspected closely a Scarlet Robin *(Petroica bicolor)* nest, containing a single nestling, was found

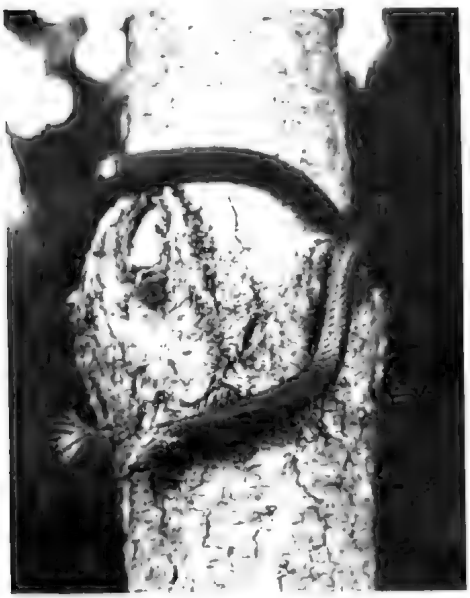

Fig. 1A: Tiger snake coiled around a young Radiata Pine in Bondi State Forest, N.S.W. Note partially overgrown branch stubs left by pruning.

Fig. 1B: Tiger snake descending from the tree using branch stubs as support. The whorl of the branch stubs shown in Fig. 1A is at the top of the figure.

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in the fork of the lowest branch, 2.4 metres above the ground. It would appear that the snake was attempting to reach the nest to prey on the young bird.

The climbing method used by this snake was not actually observed. The Tiger snake observed by Heatwole *et al.*, (1973) utilized the deeply furrowed bark, to move upwards by concertina movement, and branches for looping its body. The Radiata Pine in this observation had neither furrowed bark nor low level branches and therefore the snake could not have used this method. A more likely method of ascent would be the use of the whorls of partially overgrown branch stubs in the tree trunk, left by earlier pruning. These are spaced at varying intervals, short enough for the snake to be able to raise the front portion of its body, loop around the next whorl of stubs and then pull the rest of its body up. When first observed the snake had the front portion of its body raised and was probably attempting to reach the next whorl of stubs.

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A Short History of The Discovery and Naming of Banksias in Eastern Australia

Part III Richard Anthony Salisbury

BY A. I. SALKIN*

Richard Anthony Markham, who later changed his name to Salisbury as a condition of inheriting a large fortune, described two species of banksias in his "Prodromus Stirpium in Horto ad Chapel Alerton Vigentium (1796). These were *B. serratifolia* and *B. aspleniifolia.*

In 1809 Joseph Knight produced a work entitled "On the Cultivation of Plants belonging to the Natural Order of Proteeae". Three *Banksia* species were described from material in cultivation. A great deal of controversy surrounds this work as it was believed to emanate not from the pen of Joseph Knight but was partly if not wholly written by Salisbury. The preface to the work has a curious acknowledgement to Salisbury and there is also a hint against accusations of plagiarism.

"Perhaps few works have greater claim to originality than the present, not a single line being copied from any other. For the names only of the different Genera, their various authors are quoted, except those of R. A. Salisbury, Esq. whose manuscripts have been found useful in every sheet."

Knight's publication appeared in August of 1809. The botanical establishment of the day attributed the work to Salisbury and saw in it an attempt to publish genera and species described by Brown in January 1809, when he read his paper "On the Proteaceae of Jussieu" (Brown, 1810a) before the Linnean Society.

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Correspondence between Goodenough and Smith (Britten, 1886) reveals the depth of this distrust —

"How shocked was I to see Salisbury's surreptitious anticipation of Brown's paper on the New Holland plants, under the name and disguise of Mr Hibbert's gardener![xx] Oh, it is too bad! I think Salisbury is got just where Catilene was when Cicero attacked him, viz., to that point of shameful doing when no good man could be found to defend him. I would not speak to him at the anniversary of the Royal Society."

The antipathy and antagonism by the botanical establishment to Salisbury probably dated from a time prior to 1809. Salisbury was an acrimonious and irritable man but he also held views on classification that were anathema to many other botanists. There appears to have been, to quote Britten (1886), "A tacit understanding on the part of the botanical leaders of the period, including Brown, Banks, and Smith, that Salisbury's works and names should as far as possible be ignored". This appears to have included Salisbury's earlier work in which he published the names of two *Banksia* species. It may have been for this reason that names of two banksias published in Knight's book have different names. The first of these is named *B. serraefolia* and *B. serratifolia* Salisb. Prod r.p. 51 is given as a synonym. The second is named *B. uncigera* and *B. oblongifolia* Cav. Ic. V.6. p.28 tab 542 given as the synonym for this.

If Salisbury was the true author of "On the Cultivation of Plants Belonging to the Natural Order Proteeae" it seems curious he should forget his own previous name for *B. uncigera*.

The question naturally arises how did Salisbury get hold of material to describe his two *Banksia* species. There was of course the illicit trade and Salisbury did employ a collector, James Lee, who collected Proteaceous plants for him at the Cape and in Australia (Britten, 1917) but the answer may be simpler than this. Salisbury was not always a *persona non grata;* Smith had named the genera *Salisburia* in his honour —

"In honour of Richard Anthony Salisbury, Esq., of whose acuteness and indefatigable zeal in the service of botany no testimony is necessary in this Society nor in any place which his writings have reached." (Britten, 1917)

Salisbury for his part acknowledges help from Smith and the use of Smith's herbarium — "ex Herbario amicissima Smith".

The most plausible answer to Salisbury's descriptions of the two *Banksia* species in 1796 and 1809 is that Salisbury recognized the two species in the Linnean Society Herbarium as being distinct and obtained material from New South Wales from his collector James Lee. In 1796 he described the two species from this material and had plants propagated from seed presumably by Joseph Knight. It was this cultivated material that was described in 1809 either by Knight or Salisbury.

As to the charge of plagiarism, there is a great deal of doubt as to whether Brown's reading of his paper had any effect on the publication of these two species, whatever its effect on Knight's or Salisbury's publication of other genera and species of the Proteaceae.

Having established that Salisbury's descriptions were original the validity of the descriptions have now to be looked at. The descriptions of 1796 are very brief and compared with the descriptions of Smith (1793) quoted earlier, and Cavanilles (1800) to be quoted, are inadequate unless one is very familiar with the species concerned. *B. serratifolia* has the following diagnosis in Latin —

"5. B. foliorum laminis rectis, lineari — lanceolatis, profunde serratis, truncatis cum mucrore, adultis utrinque

[xx] Knight who had been Hibbert's gardener had acquired the famous collection of live Proteaceae as the Foundation of his nursery business.

glabris, planis. *B. serrata* Linn. Suppl. p. 126, diversissima species.

Ex Port Jackson auct Jac. Lee."

The description though brief does point out one of the major differences between *B. serrata* and *B. serratifolia;* that of the longer narrower leaves with much closer serrations.

The description of *B. serraefolia* in Knight's book is longer and the Latin diagnosis is followed by synonyms.

"This species grows wild near Port Jackson, and is common in our collections, but very difficult to increase by cuttings, nor does it flower with us so plentifully as some others. Stems villous, leaves 6 to 9 inches long, linear — lanceolate, deeply and spinulously serrated, hardy cottony underneath. Nerve prominent both above and below. Stigma not much angulated."

Banksia serratifolia does have leaves of this length but a critical diagnostic feature of the stigma is that it is more acutely angled than *B. serrata.* The description above indicates the opposite. A description of another species, *B. mitis,* which follows is given the description of "Stigma exceedingly angulated". The name of a synonym for this species is *B. serrata.*

Robert Brown's description of *B. aemula* is also brief but "type" specimens are available (Stearn, 1960). Brown in his description uses the character of the long much serrated leaf. "foliis lato-linearibus elongatis truncatis, profunde serratis" and gives the correct diagnosis for the stigma "stigmate capitato exsulco nitido apice (quadrangulo)".

Brown's description uses Salisbury's "profunde serratis" from the 1796 description but is correct on the stigma diagnosis; he does however give *B. serratifolia* as a synonym but uses a query — Salisb. Prod. 51? (Brown, 1810a).

The resolution of the problem is therefore not an easy one — on the one hand we have the priority of publication and on the other a barely adequate diagnosis and no known type specimen.

The description of *B. aspleniifolia* compared with the detailed diagnosis by Cavanilles of *B. oblongifolia,* if we accept that the height of 12 feet is an obvious mistake, is even more inadquate, nevertheless for the purpose of this article the Salisbury names will be used. Firstly, I believe that Salisbury has been much maligned and it is necessary to restore the balance, but I also think Salisbury recognised possibly as early as 1792 that *B. serratifolia* and *B. aspleniifolia* were distinct species. He appears to have consciously set out to have collections made and in the case of *B. serrata* and *B. serratifolia* used the methods of experimental cultivation in order to resolve differences that are essentially minor genetic ones.

One curious omission is that he did not note and presumably failed to observe that *B. aspleniifolia* develops a large and distinctive lignotuber and one can only assume that the taxonomic significance of this organ escaped the notice of the botanists of this period.

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F.N.C.V. Excursion to Flinders Island, 13th to 20th January, 1980.

Conditions at Tullamarine airport were overcast when the T.A.A. charter plane with 36 Victorian Field Naturalists as passengers left for Flinders Island on the 13th January. There was broken cloud cover for the trip along the Victorian coast with views of Phillip Island, Wonthaggi, Cape Paterson, Inverloch and Anderson's Inlet, Waratah Bay and Shallow Inlet, and the large sandblow on the Yanakie Isthmus. Much of Wilson's Promontory, Bass Strait and Flinders Island were covered by clouds. At Flinders Island airport there was bright sunshine and a strong westerly wind both of which continued for the rest of the day. We were met by the school bus which was to transport us for each day of our week on the island.

Fourteen of our number had accommodation at the guest house near the airport while the others, plus two who had flown over from the mainland a day earlier, stayed at the hotel in Whitemark. After lunch a smaller school bus collected the fourteen from their rural retreat to take them to Whitemark as it did all week. The afternoon was spent exploring around the town and along the beach. Swamp Harriers, Masked Plovers, Silver Gulls, Pacific Gulls, Silvereyes, (Tasmanian form) and Blue Wrens were seen during the afternoon. That evening we all gathered in the hotel lounge to meet John Whinray, our leader for the week, and discuss plans for our proposed outings.

Monday, 14th January. A fine clear morning. All joined the large bus at Whitemark for a trip to Patriarchs Inlet. Much of the road was through land which had been cleared and drained for the Soldier Settlement scheme during the 1950's. Although the roadsides in these areas were bare there were compensations for we could see a variety of birds in the paddocks.
Starlings, Swamp Harriers, White-faced herons at dams, and large flocks of Cape Barren Geese. When we stopped to admire them as they grazed they rose and circled before they flew to other paddocks. The bus took us a short distance along a bush track before we left it to stroll along the track to the Inlet. Eucalyptus Globulus was the dominant large tree in this area with an understorey of Common Cassinia *(C. aculeata)*, Narrow-leaf Wattle *(Acacia mucronata)*, Broom Tea-tree *(Leptospermum scoparium)*, Hazel Pomaderris *(P. apetala)* Coast Tea-tree *(Leptospermum laevigatum)*, Currant Wood *(Monotoca glauca)*, Coast Beard-heath *(Leucopogon parviflorus)* with its white berries called "currants" by the locals, and eaten by the Cape Barren people, and Scented Paper-bark *(Melaleuca squarrosa)*. There was also Swamp Paper-bark *(M. ericifolia)* Golden Tip *(Goodia lotifolia)*, Sallow Wattle *(A. longifolia)*, and *Callitris rhomboidea* here known as Cape Barren Pine but in other parts of Australia often called Oyster Bay Pine. Among the Tasmanian Tea-tree *(Leptospermum glaucescens)* with its distinctive red juicy fruit and the Silver Banksia *(Banksia marginata)* were Grey Fantails and Crescent Honeyeaters. At a lower level were bushes of *Correa reflexa* with occasional green bells, Fireweed Groundsel *(Senecio linearifolius)* Trigger Plants *(Stylidium graminifolium)*, tangles of *Clematis microphylla*, Coarse Dodder Laurel *(Cassytha melantha)* with its coarse stems and large fruits, and also some Downy Dodder Laurel *(Cassytha pubescens)* with fine string-like stems. There was Pink Beard-heath *(Leucopogon ericoides)* and Twiggy Daisy-bush *(Olearia ramulosa)* and two Sword-sedges . . . *Lepidosperma concava* and *L. elatus*, with Tassel Rope-rush *(Hypoleana fastigiata)* and bushes of Tree Everlasting *(Helichrysum dendroideum)* with Cherry Ballart *(Exocarpus cupressiformis)* and Dagger Hakea *(H. teretifolia)*.

Along a damp bank which had been scraped bare by a bulldozer draining the track minute plants had re-established themselves. There was angled Lobelia *(Lobelia alata)*, Creeping Cotula *(Cotula repens)*, the Tiny Sundew *(Drosera pygmaea)*, Swamp Weed *(Selliera radicans)*, Swamp Goodenia *(Goodenia humilis)*, Swamp Mazus *(Mazus pumilio)*, Swamp Clubmoss *(Selaginella uliginosa)*, Creeping Woodsorrel *(Oxalis corniculata)*, Prickly Couch *(Zoisia macrantha)*, Dwarf Bog-rush *(Schoenus maschalinus)*, Creeping Raspwort *(Haloragis micrantha)* and a tiny Violet. Black-faced Cuckoo Shrikes swooped past us here before we came to the open view of Patriarchs Inlet, with a wonderful expanse of water for the Birdos to

see Pelicans, Black Cormorants, Sooty Terns, Sooty Oyster Catchers, Masked Lapwings, White-fronted Chats, Red Capped Dotterels, Caspian Terns and New Holland Honeyeaters. On the low lying salty flats were patches of Pricklefoot *(Erynigium vesciculosum)*, Rounded Noon-flower *(Disphyma blackii)*, Purple Swainson Pea *(Swainsona lessertifolia)*, Pale Goosefoot, *(Chenopodium glaucum)*, with Bower Spinach *(Tetragona implexicoma)* growing over some of the small shrubs. Woolly Xanthosia *(Xanthosia pilosa)* was noted on the walk back to the bus for lunch as well as wasp holes in the sandy track. A beautiful specimen of Hyacinth Orchid *(Dipodium punctatum)*, Woolly Heath *(Epacris lanuginosa)*, and small patches of Silver Everlasting *(Helichrysum dealbatum)* were by the lunch spot where Welcome Swallows and Black Currawongs flew over as we ate. There was a brief stop back on the main road to view dozens more Cape Barren Geese near a Little Pied Cormorant on a dam, while Pipits rose from the roadside.

Our next stop was at a hillside forest area which marks the junction of many mainland and Tasmanian plants. Furze Hakea *(Hakea ulicina)* which has its Southern limit here on Flinders Island was here as well as Spreading Wattle *(A. diffusa)*, Prickly Geebung *(Persoonia juniperina)*, Swamp-heath *(Epacris paludosa)*, and Pink Swamp-heath *(Sprengalia incarnata)* were both here, Silky Hakea *(H. sericea)*, Star Daisy-bush *(Olearia stellulata)*, Rough Guinea-flower *(Hibbertia aspera)*, a Wedge Pea *(Gompholobium sp.)*, Guitar Plant *(Lomatia tinctoria)* endemic to Tasmania, Blue Damperia *(Damperia stricta)*, Climbing Apple-berry *(Billardiera scandens)*, Spreading Rope-rush *(Calorophus lateriflorus)*, and two ferns . . . Screw Fern *(Lindsaya linearis)*, and Comb Fern *(Schizea bifida)*. There were a few flowers of Butterfly Flag *(Diplarrena moraea)* and great excitement when first specimens of the Large Tongue Orchid *(Cryptostylis subulata)* were found and then the Small Tongue Orchid *(C. leptochila)*.

Our final stop for the day was beside a peaty swamp where we found Slender Honey-myrtle *(Melaleuca gibbosa)*, Forked Sundew *(Drosera binata)* with its lovely white flowers 2 cm across, Swamp Boronia *(Boronia parviflora)*, small Fairies' Aprons *(Utricularia laterifolia)*, Blunt-leaf Heath *(Epacris obtusifolia)*, Yellow Hakea *(H. nodosa)*, and Mealy Honey-myrtle *(Melaleuca squamea)*. Jewel spiders had webs hung between the low shrubs. Seeded specimens of Veined Sun-orchid *(Thelymitra venosa)* and many flowers of the Horned Orchid *(Orthoceras strictum)* were a delight as we were told that the Horned Orchid had only been found three times previously in the Eastern Bass Strait islands. Slender Clubmoss *(Lycopodium laterale)* and more Comb Fern were here. Yellow-tailed Black Cockatoos flew over across to a nearby hill. Along the edge of the road were plants of Bundled Guinea Flower *(Hibbertia fasciculata)* and another Hyacinth Orchid as well as a large brown grasshopper with bright orange beneath its wings.

Tuesday, 15th January. A very strong North wind was blowing as we again headed North from Whitemark to find a sheltered spot for the morning's exploration. From the central cleared plains we turned through private property to Summer Camp Gully. This spot has permanent water and had been used for over one hundred years by kangaroo hunters when kangaroo skins had been one of the islands early exports. This practice ceased in 1947. After that time the area had been used as a permanent camp site for the labour force clearing land during the 1950's Settlement scheme. As a consequence of this continued use of the area there had been frequent burns but there are still some large trees and thick regrowth. Hazel and Swamp Paper Bark had overgrown the old track which led to the steep rocky gully where there was a waterfall and a small dam for farm water supply. There was a patch of Scrub Nettle by the track while Clematis arisata, Apple-berry, and Wonga Vine *(Pandorea pandorana)* twined in the trees. John Whinray told us that this plant of Wonga vine and some others at the SE of Flinders Island are the only two Tasmanian records of this plant. Shrubby Velvet-bush *(Lasiopetalum dasyphyllum)* and Golden Tip were here with Large-leaf Bush-pea (Pultenea daphnoides), Hop Bush *(Dodonea viscosa)* and Tree Zieria *(Zieria arborescens)* The final climb to the gully where the reservoir had been built was past some Rough Tree-ferns *(Cyathea australis)*, Privet Mock-olive *(Notolea ligustrina)*, and Tasmanian endemic *Monotoca glauca*, and Blue Olive-berry *(Eleocarpus reticulatis)*. Above the waterfall was the object of our scramble to find it . . . Tasmanian Blanket-leaf

(Bedfordia linearis) the only specimen known on the island. There were lichens and dry mosses on the granite rocks, and Necklace Fern *(Asplenium flabellifolium)*, Small Poranthera *(P. microphylla)*, a minute Stonecrop *(Crassula sp)*. Lower in the gully were Prickly Currant Bush *(Coprosma quadrifida)*, Pink Berry *(Cyathodes juniperina)*, Narrow-leaf Wattle, Hop Goodenia *(G. ovata)*, White Kunzea *(K. ambigua)*, Common Wedge-pea *(Gompholobium huegelii)*, Shrubby Spurge *(Phyllanthus gunnii)*, Rough Guinea-flower, Ivy Flat-pea *(Platylobium traingulare)*, and Hard Water-fern *(Blechnum procerum)* and Sickle Fern *(Pellaea falcata)* with masses of Scrambling Coral-fern *(Gleichenia microphylla)*. Droppings of the Brush-tail Possum were found. During the lunch break we saw Black Cockatoos, Green Rosellas, Flame Robins, a Brown Falcon as well as skinks and bullants.

As we headed South on the open road towards a peak named The Dutchman we saw a Swamp Harrier, Nankeen Kestrels and White-faced Heron with more Cape Barren Geese at a dam. During a short stop at the North end of The Dutchman we found *Hakea epiglottis*, a Tasmanian endemic which grows no further N than Flinders Island — and not in the N of the island. Also here was Leucopogon esquamatus which grows in NSW and Tasmania and misses all but the extreme East of Victoria. As well there was Prickly Geebung *(Persoonia juniperina)*, Dusty Miller *(Spyridium parvifolium)*, Silky Guinea-flower *(Hibbertia sericea)* Short Purple-flag *(Patersonia fragilis)*, Tall Lobelia *(Lobelia gibbosa)*, a metallic skink and two Mountain Dragons.

After an adventurous trip alongside a road in the making our final stop was at Logan's Lagoon Conservation area of 2000 acres. This lagoon is very shallow and is filled by both rain water and occasional salt flow from the sea. A very strong West wind had blown up during the day and had swept the shallow water to the far side of the lagoon towards the coast. The keen birdwatchers had to take off their footwear and paddle over a slimy surface until they were within sighting distance of thousands of waders and other water birds — Swans, Ducks, Sand-pipers, Fairy Terns, Silver Gulls, Pelicans, Little Stints, Caspian Terns, Red-capped Dotterels. Those who remained on shore had the lovely sight of seeing huge flocks of these birds rise and wheel in the sunlight as they were disturbed by the advance of the birdos. Around the shore of the lagoon were burrows of the Eastern Swamp Rat in the recently burnt tussocks and shell beds. Among the plants were Angled Lobelia, tiny plants of Sea Celery *(Apium prostratum)*, Creeping Monkey-flower *(Mimulus repens)*, and *Epilobium* sp., a Fan-flower *(Scaevola sp.)*, a Tasmanian endemic *Nablonium calceroides*, Candles *(Stachhousia monogyma)*, *Pelargonium inodorum*, a Blue-bell *(Wahlenbergia sp.)*, Tasman Flax-lily *(Dianella tasmanica)*, *Cotula* sp., Sea Rush *(Juncus maritimus)*. Our final interesting find in this spot was a Tasmanian Spiny Ant-eater among the tussocks and Coastal Teatree by the track. It was lighter in colour than the mainland species with its spines almost hidden by fur.

Wednesday, 16th January was a fine calm day so we were able to visit Big Green Island. A small boat ferried us eight per trip across the smooth water with fine views back to Flinders Island with the Strzelecki Peaks dominating the scene. Our boatman advised us that if we wished to swim to do so during the morning for the tide would be out later in the day when at low tide 80 acres of reef are exposed. So a few from each boatland swam while waiting for the rest of the party to arrive. Those who went walking along the sandy beach saw both Sooty and Pied Oystercatchers, Silver Gulls, Turnstones and Gannets.

At the landing cove was a sheep race which led from yards and a shearing shed. Higher on the hill was a house with a detached kitchen which had been built in 1872. Grazing had commenced on the island in 1860 since when there had been frequent fires which have destroyed most of the original plants. The present dominant growth consists of Prickly Spear-grass *(Stipa teretifolia)*, Austral Hollyhock *(Lavatera plebeia var. tomentosa)*, Slender Thistle *(Cardus tenuiflorus)*, and Creeping Saltbush *(Atriplex semibaccata)* discovered here by John Whinray.

After lunch we walked across the island to an area of Mutton-bird burrows in a patch of Leek Lilies *(Bulbine semibarbata)*. Mutton birding has taken place on this island since 1815. Below the burrows were two sheds — one a dwelling during the birding season, and the other a processing shed for the owner of the Mutton Bird Lease for Big Green Island.

Nearby was an attractive rock-ringed circular bay with a solitary pelican. Further along this West coast of the island we visited a Penguin rookery and met one of the inhabitants. Then a walk back through the granite rocks and thistles above the rookery over the crest of the ridge and back to rest in the shade of the African Box-thorn bushes while waiting for the boat to return us to Flinders Island. The more energetic walked to a part of the exposed reef where a Black-faced Cormorant was nesting. On this walk they found plants of Creeping Monkey-flower, Pale Goosefoot *(Chenopodium glaucum)* and Leafy Peppercress *(Lepidium foliosum).*

Thursday, 17th January was another fine day with a strong West wind as our bus headed for Killiecrankie Bay on the NW of the island. We crossed the flat land between Whitemark and the airport where an early drainage scheme had taken place after settlement in 1910 to cross Pat's River where Straight Wattle *(A. stricta)* grows. Killiecrankie Bay was our first stop for exploration of beach and bush. As we arrived at 10.30 am bags of crayfish were being loaded onto a trailer for transport to the aerodrome to be in Albury (NSW) that afternoon. Three most energetic persons climbed to the coarse-grained granite outcrops high above the bay and were rewarded to find the Streaked Rock Orchid *(Dendrobium striolatum).* The less energetic were happy to wander around the shore or into the edging bush to find a variety of plants Coast Tea-tree, Coast Beard-heath, Wirilda, Sea-box *(Alyxia buxifolia),* Boobialla *(Myoporum insulare),* Box-thorn, Australian Indigo, *(Indigofera australis),* Variable Sheoak *(Casuarina monolifera),* Kangaroo Apple *(Solanum aviculare),* Common Correa, Hop Goodenia *(Goodenia ovata),* Grass Trigger-plant, Thyme Riceflower *(Pimelea serpyllifolia),* Austral Trefoil *(Lotus australis),* Cushion-bush *(Calocephalus brownii),* Coast Daisy-bush *(Olearia axillaris),* Coast Everlasting *(Helichrysum paralium),* Two-horned Sea-rocket *(Cakile maritima),* Grey Saltbush *(Atriplex cinerea),* and Pale Turpentine-bush. Growing in rock cracks in a nearby cove were small plants of Eutaxia microphylla and a Star-hair *(Astrotricha sp.)* both of which were specie records found by John Whinray. There was a tame Black-headed Cormorant near one of the houses while these other birds were seen . . . Grey Fantails, Blue Wrens, Firetails, Green Rosellas, Silver Gulls, Silvereyes and Scrub Wrens.

After lunch the bus took us to the heathlands around the old Tin Mine workings where "Killiecrankie Diamonds" are found. Some folk went sieving in the stream bed for these fine Topaz crystals . . . and some were rewarded with some very small specimens, while the Birdos went in search of Tawny-crowned Honeyeaters which they found. As well more Beautiful Firetail Finches were seen, Grey Shrike Thrushes and Yellow-winged Honeyeaters.

Along the tracks through the heathland we found Tassel Rope-rush *(Hypoleana fastigiata),* Twine-rush *(Leptocarpus sp.)* with both male and female flowers, Oval-leaf Pseudanthus *(Pseudanthus ovalifolius),* Prickly Guinea-flower *(Hibbertia acicularis),* Common Wedge-pea *(Gompholobium huegelii),* Shrubby Velvet-bush *(Lasiopetalum dasyphyllum),* bright blooms of Yellow-eye *(Xyris sp.),* the Horned Orchid, Scrambling Coral-fern, Short Purple-flag, Wiry Bauera *(Bauera rubioides),* Bundled Guinea-flower, Cone-bush *(Isopogon ceratophyllus),* Heath Parrot-pea *(Dillwynia glaberrima),* Guitar-plant, Swamp Sheoak *(Casuarina paludosa),* and Wirilda *(Acacia retinoides).* There were jewel spiders with webs between the bushes and a small fresh water crayfish was found in a damp spot.

From the Tin Mine area we were taken up the winding gravel road to the summit of Mt. Tanner where at 213 metres are the Radio Telephone Repeater Towers between Victoria and Tasmania. There were fine views both North and South over much of the western and central parts of the island. Growing in the cracks in the granite boulders and around their base were plants of Large-leaf Bush-pea, Silver Banksia, White Kunzea, Narrow-leaf Wattle, Rough Guinea-flower, Black Sheoak *(Casuarina littoralis), Phebalium bilobum,* and Cape Barren Pines.

The final stop for the day was for a visit to "Egg Beach" where there are large "Eggs" of water worn granite, many of them .5 m. in diameter. On the walk from the bus to the beach we found Swamp Beard-heath, Coast Pomaderris *(Pomaderris oraria),* while on the windswept flats behind the beach among the Poa tussocks and Speargrass were Creeping Myoporum *(Myoporum parvifolim),* Creeping Woodsorrel *(Oxalis corniculata),* Swamp Weed *(Selliera radicans),* and

Australian Salt Grass *(Distichlis distchophylla)*. Among the boulders fringing the beach were large plants of Sea Celery (Apium prostratum).

Friday, 18th January. Again a strong westerly wind as we drove SE from Whitemark to Vinegar Hill Lookout with views over the town of Lady Barron, Franklin Sound and its islands to Cape Barren Island. The bus parked on a huge granite slab. In the sands around the rock outcrops grew Black Sheoak, Cape Barren Pine, White Kunzea, a Daisy-bush and lower on the slopes Common Heath *(Epacris impressa)*. A short trip into Lady Barron to visit the wharf area where bales of wool were being loaded into the largest of the three freighters which service the island as the harbour here is deeper and more sheltered than the jetty at Whitemark. Then on for a brief stop at Petrification Bay, one of the few places where there are volcanic outcrops on Flinders Island. A sandspit here was crowded with Caspian Terns, Silver Gulls, Eastern Curlews and Whimbrels. Our lunch stop was at picturesque Trousers Point where headlands of granite rocks edged with orange lichen are topped by Black Sheoak and White Kunzea, with a view across a sandy beach to the Strzelecki Peaks. Hooded Dotterels were seen in a sandblow.

The afternoon was spent in the Strzelecki National Park for exploration along the creek and up the track leading to the summit of Strzelecki Peak. On the lower slopes along the creek was a thicket of Prickly Moses *(Acacia verticillata)*, Large-leaf Bush-pea, Kunzea and Austral Bracken *(Pteridium esculentum)*. A Spotted Skink was seen and a Blue Tongue Lizard infested with both black male ticks and grey engorged female ticks. Six small fish were seen in the stream and John told us there are four varieties of native fish on the island. In the gully where the track crossed the creek were a variety of ferns — Soft Tree-fern *(Dicksonia antarctica)*, Rough Tree-fern, King Fern *(Todea barbara)*, Soft Water-fern *(Blechnum minus)*, Hard Water-fern *(Blechnum procerum)*, Common Filmy-fern *(Hymenophyllum curpressiforme)* and Finger Fern *(Grammitis billardieri)*. These were sheltered beneath Prickly Currant-bush, both Swamp and Scented Paper-bark, a Zieria, and Pomaderris. A Hyacinth Orchid was beside the track and Striped Rock Orchid plants were on a rock beside a waterslide. (Later that afternoon we saw these latter on a huge isolated boulder in a windswept paddock). Across the creek the steep gravelly track continued straight up the steep hillside to the edge of large granite slabs. From clearings beside these rocks there were views out to the islands to the West and over Trousers Point to the South. There were fine specimens of large quartz crystals in some of the cracks in the granite. Only five of the most energetic continued on the strenuous climb about two thirds of the way to the summit. Along the track were Tasmanian Hakea, Short-flower Westringia *(Westringia brevifolia)* and Scented Everlasting *(Helichrysum argophyllum)* and a Mountain Dragon Lizard.

Saturday, 19th January. An even stronger West wind was blowing on this morning where our first stopping place was out at Bluff Point beach just beyond the guest house. The tidal flats here were sheltered by the slight rise of The Bluff and we saw Plovers, Silver Gulls, both Sooty and Pied Oyster-catchers, White-fronted Chats among the channels and sand bars with growths of Beaded Glasswort *(Salicornia quinqueflora)*, Rounded Noonflower, Cudweed *(Gnapthalim candidissimum)*, Salt Lawrencia *(Lawrencia spicata)* and Cushion Bush. There was a variety of grasses and rushes . . . Marram Grass *(Ammophila arenaria)*, Speargrass, Coast Saw-sedge *(Gahnia trifida)*, Common Sword-sedge, *(Lepidosperma longitudinale)*, Knobby Club-rush *(Scirpus nodosus)*, and Tall yellow-eye. *(Xyris operculata)*. Further up the slope was Large Kangaroo-apple *(Solanum laciniatum)*, Swamp Paper-bark, Coast Tea-tree, Black Sheoak, Boobialla, Giant Hop-bush, Twiggy Daisy-bush, Wiry Bauera, with tangles of Dodder Laurel *(C. melantha)* and Small-leaved Clematis among them as well as Climbing Lignum *(Muehlenbeckia adpressa)* and Ivy Flat-pea on the ground with Hairy Centrolepis *(Centrolepis strigosa)* and Woolly Xanthosia. Edging the sand which was being blown by the wind on the exposed beach around the point was Two-horned Sea-rocket.

After this we proceeded North once more until we stopped to visit a fascinating private gemstone and shell collection as well as viewing the surrounding garden which had been established after the land had been completely cleared for settlement in 1950. Our lunchtime stop was at Allport's Beach where

we watched the surge of the incoming tide and found a variety of coastal plants . . . .Coast Twinleaf *(Zygophyllum billardiera)*, Grey Salt-bush with its distinctive male and female flowers, Coast Everlasting, Correa, Marsh Salt-bush *(Atriplex paludosa)*, Wallaby Salt-bush *(Threlkeldia diffusa)*, Showy Cassinia *(Apalochlamys spectabilis)*, Ross's Noonflower *(Carprobotus rossii)*, Water Plantain *(Alisma plantagoaquatica)*, masses of Bower Spinach *(Tetragona implexicoma)*, over some of the shrubs and lower branches of Pale Turpentine-bush, Sweet Bursaria *(Bursaria spinosa)* and Large Kangaroo Apple. An immature White-breasted Sea Eagle was seen and a Yellow-throated Honey-eater was feeding on the berries of Coast Beard-heath.

In the early afternoon we paid a visit to the Museum conducted by the Furneaux Group Historical Research Association where we saw many of the historical records and relics of the islands. Then we went on to see the Wybalenna Chapel and Burial Ground at the site where the remnants of the Tasmanian Aboriginal tribes were taken in 1830 in an unsuccessful endeavour to preserve their race. Our final stop for the afternoon was at Port Davies by the long disused and damaged timber jetty. Here the wind seemed even stronger than earlier in the day as it blew over the hardy bushes of White Correa *(Correa alba)* on the exposed headland of granite with colourful bands of orange lichen around them. Within the bay to the East was an interesting outcrop of limestone with a "mushroom" rock island. White-fronted Chats were busy among the bushes.

In more sheltered parts of the island we had seen some butterflies during the week . . . mostly Meadow Browns which John told us were the most common. Cicadas had been heard in many places and their nymph cases found on trees.

That evening we all met at the C.W.A. hall in Whitemark with John Whinray and our bus driver, Leedham Walker and his wife when John gave us a short talk on the history of the island and of the sealing and hunting trades of earlier years. He also told us of the mutton birding industry and its methods and developments over the years. He then showed us a fascinating selection of coloured slides of various of the Bass Strait islands with details of the history and flora and fauna of each one. At the conclusion thanks were expressed to John for the evening's program and for his time and knowledge which he had given so generously during our stay on the island. Thanks were also given to Leedham for the care and patience he showed to our bus load.

My thanks to Marie Allender for organising the trip, to John Whinray for his great assistance with plant names, to those other F.N.C.V. members who helped compile the plant list, and to Cecily Allen who supplied the Bird List.

Eulalie P. Brewster.

BIRDS SEEN ON FLINDERS ISLAND 13th. to 20th., January, 1980.

*Denotes breeding

* Little Penguin
* Short-tailed Shearwater
Pelican
* Black-faced Cormorant
Little Black Cormorant
White-faced Heron
Little Egret
Black Swan
Cape Barren Goose
Mountain Duck
Grey Teal
Musk Duck
White-breasted Sea Eagle
Swamp Harrier
Brown Falcon
Pied Oystercatcher
* Sooty Oystercatcher
Masked Plover
Hooded Dotterel
Red-capped Dotterel
Turnstone
Eastern Curlew
Whimbrel
Sharp-tailed Sandpiper
Red-necked Stint
Curlew Sandpiper
Silver Gull
Pacific Gull
* Caspian Tern
Fairy Wren
Crested Tern
Yellow-tailed Cockatoo
Green Rosella
Fan-tailed Cuckoo
Kookaburra
Skylark
Welcome Swallow
Tree Martin
Pipit
Black-faced Cuckoo-shrike
Blackbird
Flame Robin
* Dusky Robin
Golden Whistler
Grey Shrike-thrush
Grey Fantail
Superb Blue Wren
White-browed Scrubwren
Tasmanian Thornbill
Yellow-throated Honeyeater
Strong-billed Honeyeater
Crescent Honeyeater
New Holland Honeyeater
Tawny-crowned Honeyeater
Eastern Spinebill
White-fronted Chat
Silvereye
Goldfinch
* House Sparrow
Beautiful Firetail
Common Starling
Australian Magpie
Black Currawong
Forest Raven
Blue-winged Shoveller.

The Origin of Generic Names of the Victorian Flora

Part 3 — Latin, Greek and Miscellaneous

(Continued from page 136, Vol.98, No.3)

By James A. Baines

Vitis. The Lat. name for the grapevine. *Vitis hypoglauca* was Mueller's name for the Jungle Grape, but A. Gray's prior name of *Cissus hypoglauca* is now the valid name; the plant is in family Vitaceae, named from the genus.

***Xanthium.** Gk xanthion, name of a plant said by Dioscorides to be used for dyeing the hair yellow (from xanthos, yellow); in allusion to yellow flowers. **X. spinosum*, Bathurst Burr, of Chilean origin, was inadvertently imported into Australia tangled in the tails of horses, in the 1840s, and was first recorded near Bathurst, N.S.W., in which colony it was naturalized by 1850, and in Victoria soon after. It has also been known as Common Cockleburr, and, in U.S.A., as Spiny Clotbur or Cocklebur. **X. pungens*, Noogoora Burr, was first noticed on Noogoora cattle station, near Ipswich, Qld., and is thought to have been introduced with North American cotton seed. Our third species, **X. orientale*, Californian Burr or European Cockleburr, has names indicating the doubt about the origin of some species, so much have the burrs spread these plants over many years. Sometimes the flowers are greenish and the fruits yellowish, and a yellow dye is obtained from Bathurst Burr. They are all proclaimed noxious weeds. The genus is in family Compositae.

Xanthorrhoea. Gk xanthos, yellow; rheo, flow; alluding to the resin ('gum') that flows from the stem. Victoria's 3 species are all known as different kinds of grass-tree (from the appearance and height of the foliage), but in S.A. the name Yacca is more usual, and in W.A. Blackboys. Some botanists place it in its own tribe of Liliaceae, while others give it family status in Xanthorrhoeaceae.

Xanthosia. Gk xanthos, yellow; from the colour of the hairs on some species. Victoria has 4 species, all known as kinds of Xanthosia, but one of them, *X. pilosa*, Woolly Xanthosia, is known as Hairy Southern Cross in N.S.W., probably on analogy with one of W.A.'s 13 species, *X. rotundifolia*, which first was given the name Southern Cross. The genus is umbelliferous.

Xerotes. Gk xerodes, looking dry (from xeros, dry). Nine of our 10 species of *Lomandra* were previously referred to this genus, in tribe Xeroteae in family Liliaceae. Probably named by Labillardiere (1805) from one of the species preferring an arid habitat.

Xyris. Gk name for a species of iris. Victoria has 3 species, all known as different kinds of yellow-eye. The genus gives its name to family Xyridaceae.

Zannichellia. Named by L. after G. G. Zannichelli (1662-1729), an Italian botanist, of Venice. Two of our 4 species of *Lepilaena*, Slender and Long-fruited Water-mat respectively, were formerly in *Zannichellia*, which gives its name to Zannichelliaceae, the family to which they belong. (Omitted from Part 1, so included here.)

***Zea.** Gk zeia, zea, name of a sort of grain, used as fodder for horses, probably spelt, a coarse wheat. **Z. mays*, Maize, Indian Corn, called Corn in U.S.A., is much cultivated, especially on river flats in Gippsland, but does not persist long away from arable fields. Mealies is a South African common name. The word maize comes from mahiz, the name in the old Carib dialect of the island of Haiti, although the original habitat was highland Mexico.

Zostera. Gk zoster, a girdle; alluding to the ribbon-like leaves. Victoria's 2 species are both known as kinds of grass-wrack. The genus gives its name to family Zosteraceae.

Zygophyllum. Gk zygon, yoke, pair; phyllon, leaf; referring to the pair of leaflets which compose each leaf; hence the common name twin-leaf, by which Victoria's 9 species are known, with a distinguishing adjective in each case. They are sometimes known as Squash Bushes in S.A. The genus gives its name to family Zygophyllaceae, which has 25 genera and 240 species.

Editor's note: This completes the series of articles by the late Mr James Baines on The Origin of Generic Names of the Victorian Flora (Part 3). The series spanned several years of *The Victorian Naturalist* and has proved extremely popular with its readers. Copies of the references used by Mr Baines as sources for his Parts 1 and 2 are available on request from the editor.

Summer on Mt. Kosciusko

(Report of F.N.C.V. Excursion, *17th-25th January, 1981)*

BY ELIZABETH K. TURNER* AND MARY K. DOERY

We arrived, all forty four (44) of us, at our first night's stop at Orbost at 5 p.m. on a hot, muggy day. East Gippsland was alleged to be in the grip of a 2 year drought, but owing to a 3 in fall of rain a few weeks previously, the fields looked green and lush.

We had enjoyed a picnic lunch under the shade of gum trees in Jean Galbraith's front garden at Tyers. On the front gate she had left a notice "Follow the green hose to picnic spot", and here iced lemonade and biscuits were dispensed. Later we enjoyed a view of the bower of the Satin Bower Bird nearby. It was surrounded with blue drinking straws, thoughtfully provided on the bird tray by friends.

Beyond Swanreach we noted Red Box *(E. polyanthemos)* along the roadside in association with Red Ironbark *(E. sideroxylon).* A large area of the Colquhoun Forest, near Lake Tyers, was brown due to a recent deliberately-lit bush fire.

Next day, Sunday, 18th January, we saw the devastation left by the October, 1980, bushfires starting just east of the Brodribb River timber mills and ending just west of Cabbage Tree, apparently sparing the *Livistona* remnants there; more extensive devastation had been left by clear-felling in the Bondi State Forest just north of the N.S.W. border; where to our amazement and concern we saw miles of bare hills being planted with *Pinus* sp.

Seeing the distant snow-clad Alps in the west when we reached Nimmitabel seemed to alleviate the discomfort of the heat, and at Cooma in the Park where we had lunch, the temperature was palpably lower and there was a breeze. Murray Pines *(Callitris columellaris)* showed as dark green patches on the hills amongst the rosy pink trunks of *Eucalyptus rubida* and other eucalypts, and by the roadside we saw clumps of blue *Walhenbergia* sp., Paterson's Curse *(Echium lycopsis),* and orange-yellow clustered Helichrysum, *(H. semi-papposum)* as well as an occasional pink Hyacinth Orchid *(Dipodium punctatum).* Alan Morrison mentioned that he had once seen wallabies feeding on these flowers, and Dick Morrison told a tale of Stump Tailed Lizards eating orchid flowers in the Grampians.

We attended an audio-visual session at the Kosciusko Park Headquarters and reached the Wilson's Valley (the site of a former cattleman's hut) at the new Ski Riders Motel, in time for a cup of tea.

From the coach we saw several Wedge-tailed Eagles and what appeared to be an incongruous White-breasted Sea Eagle sitting in a gum tree nowhere near any water. After dinner, it was warm and still as we walked along the Valley Road. There were calls of the Currawong, Crimson Rosella, Gang Gang, Tree Creepers and various honeyeaters, and the roadside was lined by

the Scaly Everlasting *(Helichrysum hookeri)* and clumps of golden yellow Button Everlasting *(H. scorpioides)* and yellow *Kunzea mulleri.* A large, aggressive Wolf Spider was caught and photographed with young on her back. Also a large black, flying, male Mountain Grasshopper was caught.

Next morning, Monday, 19th January, after a brief visit to the brand-new town of Jindabyne for supplies, we accompanied the Ranger on a 4 Km. walk to Rainbow Lake, a man-made lake formerly the water supply for the Hotel Kosciusko, now known as Sponar's Lodge. Approximately 100 people arrived for the walk, and the young Ranger called on members of the F.N.C.V. to lead groups, most comprising some families and young children. We walked on a track over subalpine heathland where Snow Gum *(E. pauciflora* subsp. *niphophlia)* grew, and down into sod tussock grasslands where golden *Craspedia* sp. and bright pink Trigger plants *(Stylidium graminifolium)* alternated with yellow *Kunzea muelleri,* blue *Wahlenbergia ceracea* and the Silver Snow Daisy *(Celmisia longifolia).*

We were able to observe the male and female plants of the Mountain Aciphyll *(Aciphylla simplicifolia),* a small species with slender segmented leaves, and the Australian Carraway *(Oreomyrrhis eriopoda)* and some of the children tasted the leaves of the Mountain Pepper *(Drimys lanceolata)* and were interested in the way in which the Wombat marked the territory around his burrow with piles of faeces carefully deposited on strategic rocks.

The tiny plum pine *(Podocarpus lawrencei)* was found near a stream and there were several patches of Alpine Leek Orchids *(Prasophyllum alpinum* and *P. suttonii)* in flower. The minute two-flowered Knawel *(Scleranthus biflorus)* showed up as patches of bright yellowish-green, and in some areas the pale violet flowers of the mud Pratia *(P. surrepens)* covered the depressions between the sod tussocks.

Epacris microphylla and *E. breviflora* were seen and the Candle Heath *(Richea continensis)* was still in flower in some areas.

One of the rarer finds was the dark red Dead Horse fungus *(Aserol rubra),* the tubular cup of which exuded a stench which attracted the pollinating flies. Two species of Rice Flower *(Pimelea axiflora* and *P. ligustrina)* were found and one beautiful plant of golden Podolepis *(P. robusta)* delighted the children. A Sacred Kingfisher caused consternation amongst Grey Leaden flycatchers, but a female Rufous Whistler went on feeding without concern. Flame Robins were not uncommon in the Snow Gum woodland, and the hot sun sank early into a mass of thundery-looking clouds.

No thunder or rain eventuated and Tuesday, 20th January, was hot and still — so we were relieved to spend the day around the summit of Mt. Kosciusko, 2,228 m. (7,314 feet); most of us returned very sunburned and bitten by myriads of particularly large March flies with beautiful green eyes.

Since 1956, cattle grazing has been banned in the Kosciusko Alpine Park, and much of the flora is regenerating. The Parks and Wildlife Service is also regulating the human invasion, and no vehicular traffic is allowed beyond Charlotte's Pass. Shuttle buses run from Perisher to the Summit turntable for 6 weeks in the summer only, and the ascent to the Trig Station on the summit is made on foot.

A few snow drifts had survived the heat on the eastern slopes of the mountain and below one of these drifts Barbara Morrison discovered a beautiful clump of white Anemone Buttercup *(Ranunculus anemoneus)* which enticed most of the party to make the climb to photograph and enjoy it. There were many bright green clumps of *Caltha intraloba,* the Alpine Marsh marigold, showing their characteristic twin-lobes at the base of the leaves, but as yet no flowers had appeared. However, as if to compensate, the Wreath Pennywort *(Dichosciadium ranunculaceum* var. *ranunculaceum)* made extensive white flowered rosettes around large palmately lobed hairy leaves. *Gentianella diemensis,* the mountain Gentian, was in bud and we found but three delicate white flowers fully opened.

The Alpine Mint-bush *(Prostanthera cuneata)* was in flower along the verges of the road, and we were fascinated to discover deep below the stiff pointed silvery leaves of the Pineapple Grass *(Astelia alpina)* the exserted yellow male inflorescence, and on a separate plant the even lower female inflorescence often bearing orange-yellow fruits. On the Sphagnum moss beds grew the glistening Alpine Drosera *(D. arcturi)* with a single white flower, and close by grew patches of the Stiff Diplaspis *(D. hydrocotyle)* which had attractive clusters of terminal fruits born on thick hollow stalks. Another attractive,

fragrant mat of creamy-yellow flowers was the alpine stackhousia *(S. pulvinaris)* and it took us some time of puzzling to discover that the beautiful pale pink or white flowers of our old friend *Claytonia*, are now known as *Neo-paxia australasica*.

The most showy plants of the summit were surely the carpets of Silver Snow Daisy, and the lilac Eyebright *(Euphrasia collina* sp.) and the rather sprawling clumps of Mountain Celery *(Aciphylla glacialis)* with male and female flowers on separate plants, Yellow Billy-buttons or *Craspedia* sp. made a bright show, and there were patches of violet Mountain Willow-herb *(Epilobium sarmentaceum)*.

The heaths, chiefly *Epacris glacialis, E. microphylla*, and *E. petrophilia* (the Snow Heath) were flowering conspicuously on the rocky slopes. The Carpet Heath, *(pentachondra pumila)* together with the Snow Beard Heath *(Leucopogon montanus)* had both white star-like flowers and crimson fruits on the same plants.

Brachycomes, with white and pale pink flowers were common and near the summit there were clusters of *Helipterum albicans*, the Alpine Sunray with large, white papery flowers with yellow centres and woolly, silvery leaves; the so-called Australian Eidelweiss *(Ewartia nubigena)* persisted in growing on the rocky pathways and thus their mats of attractive inflorescences were often much bruised. Some of the party found fine specimens of the Alpine Groundsel *(Senecio pectinatus)*. The Prasophyllum orchids (both *P. alpinum* and *P. suttonii)* were in profusion, but no other orchids were found. Several species of *Colobanthus*, the Cushion plant, were identified, the Dwarf Buttercup *(Ranunculus millanii)* and several other Buttercup species were found, as well as the pink, sweetly perfumed flowers of the Alpine Riceflower *(Pimelea alpina)*. A pinkish *Baeckea gunniana* grew closely over some rocks in a small mountain stream.

A vain search was made for the spectacular Corroboree Frog, but other frog species were found; and a Nankeen Kestrel was seen divebombing a large, Wedge-tailed Eagle.

After a picnic lunch near the summit, some of our members went gaily for a swim in the snow-melt waters of Lake Cootapatamba; (Fig.1).

Our first stop on Wednesday, 21st January, was at the tall circular Snowy Valley Lookout Tower which actually overflowed with the enormous back pressure of water when a rock fall a few weeks ago blocked the Jindabyne-Island Bend water tunnel of the Snowy Mountains Hydro-electric Scheme. A team of tunnellers was boarded at our Motel.

Our bus then took us southwest to Thredbo Village, 35 kilometres from Jindabyne. At first the road ran beside Wollondibby Creek and then ran west to the Crackenback River Valley. The Crackenback Chairlift starts from the Valley Terminal in the Village, and most of us ascended by this means from 1,380 metres to the treeless top of the Ramshead Range at 1,990 m. Some also descended in the same fashion, but for those of us who walked down Merrit's Track there were faunal and floral rewards (see cover photo).

Firstly, we were able to observe two slender white-lipped snakes which crossed our path, and several almost tame water skinks which refused to be easily disturbed from sunning themselves on the rocks. Merrit's Track started in the treeless alpine zone between massive granite boulder outcrops where the vegetation was predominantly snow grass *(Poa caespitosa)* and then descended by a series of steep steps into the subalpine woodland, and the snow gums. Here we were amongst heathlands of *Bossiaea foliosa* with minute leaves and a large area of Mountain Plum Pine *(Podocarpus lawrencei)* some trees being 6-8 feet high and some espaliered on the granite boulders, their new growth at the tips having a purplish tinge. *Lycopodium fastigiatum*, the Mountain Club Moss was found under the shrubs, and we were delighted by the carpets of yellow flowering *Goodenea hederacea* which often overhung the banks along the path. Patches of bright Alpine Groundsel *(Senecio pectinatus)* enlivened the scene, and we discovered a mat of lilac fan-flower *(Scaevola hookeri* var, *alpestris)*. We saw fruits but no flowers of the Ovate Phebalium *(P. ovatifolium)* which is restricted to the Mt. Kosciusko alpine and subalpine regions. *Prostanthera cuneata* was in flower, and when we reached the Ramshead Creek crossing, *Prosthanthera lasianthos* the pale, lilac flowered Christmas Bush was also flowering.

We noted the leaflets of the high altitude form of the red-headed *Acaena* sp. were broader than those at lower altitudes. The Lady's Mantle *(Alchemilla xanthochlora)* with its large fan-like leaves and clusters of small greenish flowers is apparently very akin to the European widespread form, and may

have been a very early introduction to Australia.

Part of the track lay along the ski slopes which had been cleared, and here small herbs like the Woodruff *(Asperula minima)*, and the deep blue *Wahlenbergia gloriosa* and *Geranium* sp. were in flower.

We entered a wet, sclerophyll forest of Alpine Ash *(E. delegatensis)* which is said to grow generally between 1,220 and 1,525 metres elevation — here also Black Sallee *(E. stellulata)* which was recognized chiefly by its star-like clusters of buds, grew with the Snow Gum *(E. niphophila)* and a Hickory Wattle *(A. obliquinervia)* appeared. We crossed the Ramshead Creek and eventually by following the banks of the Thredbo river, we crossed back to where the bus awaited us in the Thredbo Village. A thunder-storm brought a heavy rain shower on our homeward drive but the temperature remained fairly warm.

Two of the Park Rangers took a party of us spotlighting in the Sawpit Creek Forest on the Waterfall Track. After 2 hours all we had seen was a White-Lipped Snake, a large Huntsman Spider, and the moonlight filtering down between the motionless branches of some enormous Candlebark and Snow Gums.

Thursday, 22nd January, dawned cooler with banks of black clouds rolling in from the Dividing Range in the north only to disperse as they reached us. The shuttle bus from Perisher was cancelled owing to a gale on the summit, but from our Motel at Wilson's Valley approximately 1,230m. we descended to Sawpit Creek at 1,159m. and walked down the Pallaibo track. This is an historic track up to the alpine areas used originally by the Aborigines and is said to mean "By'n By". They used the Sawpit Creek as an easy access to the high rocky areas in early summer looking for the Bogong Moths, whose fatty tissue supplied a useful addition to their meagre winter diet. later, the same track was used by the cattlemen looking for summer pastures in the high country for their cattle; their old stock fences or "breaks" were formed of stacked dead timber and are still to be seen. The track descends south to the Thredbo or Crackenback River near the Jindabyne Road, and leads past large groups of rounded granite boulders. The predominant tree along the creek bed is the Woolly Tea-tree *(Leptospermum lanigerum)*; and the chief eucalypts, the Candlebark *(E. rubida)*. There were also *E. dalrympleana* and *E. stellulata*.

Fig. 1 Botanising at Lake Cootapatamba.

There were attractive stands of the Pearl Ballart *(Exocarpus stricta)* covered with swollen pearly lilac fruit stalks each with a jet black seed at the tip. Red berries were in abundance on bushes of *Leucopogon suavolens, Coprosma hirtella, Pimelea pauciflora* which is called the Poison Pimelea (however we ate some of the red berries with impunity) and *Asperula minima*. There was also a white flowered Lomatia *(L. fraseri)*, *Wahlenbergia* sp., the Austral Forget-me-not *(Myosotis australis,)* and the blue Violet *(Viola betonicifolia)*.

The orchids found included a fine stand of *Pterostylis decurva*, the Summer Greenhood, the Onion orchid *(Microtus unifolia)*, a Beard orchid *(Calochilus* sp.) in fruit and *Prasophyllum despectans*, the Sharp Midge orchid. The blue flowering Digger's Speedwell *(Veronica perfoliata)* grew alongside robust specimens of the white Derwent Speedwell *(Parahebe derwentia)*, Scurf-pea *(Psoralea adscendens)* was not uncommon.

The birdwatchers amongst us breathed a sigh of contentment: "Here," they said "is the first really good bird spot of this tour." There were: Gang-gang, and Sulphur-crested Cockatoos, Bronze Cuckoos, and Crimson Rosellas, White-throated Tree-creepers and Silvereyes, Red Wattle-birds and Pied Currawongs, Striated and Spotted Pardalotes, the former observed feeding young, Spine-tailed Swifts, Blue Wrens and Grey Thrushes, Restless Flycatchers and Kookaburras. Most people caught glimpses of Grey Kangaroos *(Macropus giganteus)* and some saw the Red-necked Wallaby *(M. rufogriseus)*; one Black Snake was seen and many varied sized skinks.

Our last full day on Australia's highest land mass — 23rd January was clear, almost cloudless and hot. Our first stop was on the

road just south of Charlotte Pass. Most of us ascended the rocky northern slope on which grew Snow Gum, *Prostanthera cuneata* in abundant flower, yellow *Kunzea mulleri*, heaths and Baeckeas, and the Ovate Phebalium, the latter not in flower. There was a ground cover of the Spreading Rope Bush *(Empodisma minus)* which some of us mistook for the dwarf Alpine Ballart, however, we later found a small *Exocarpos nanus* and photographed the red shining fruiting pedicel. *Podolepis* sp., *Craspedia* sp., in deep orange as well as bright yellow, the large Yam Daisy *(Microseries lanceolata)* and the Alpine Daisy Bush *(Olearia algida)*, and the Alpine Orites were all in flower.

We rediscovered many of the alpine plants from our previous days, but also found the Fetted Buttercup *(Ranunculus muelleri)* and the Granite buttercup *(R. graniticola)*. Some of the attractive and unusual monocots we found were *Luzula australasica*, one of the Juncaceae, the soft snow grass *(Poa costiniana)* and the Rock Poa *(Poa saxicola)*, Alpine Wallaby Grass *(Danthonia nudiflora)*, Velvet Wheat Grass *(Agropyron velutinum)*, Bristle Grass *(Trisetum spicatum)* whose stems are velvety-pubescent, and *Carex cephalotes* (one of the Cyperaceae) were also found. From the summit of the ridge we could see the source of the Snowy River running to the North West below us, and opposite was Mount Clark, with Mount Northcote behind overlooking the valley, and a little to the South East was Mueller's Peak, which seems to give the Melbourne Field Naturalists a feeling of familiarity with the area because of Mueller's early association with our Club.

Returning about 10 Km. to Perisher, we had lunch and then many of the party walked to The Porcupine (1,926 m.) following a track along the snow poles. The unusual plants discovered here were the Wedge Oschatzia *(O. cuneifolia)* which had long slender stalks and small white flowers; a white flowered Sky Lily *(Herpolirion novaezelandiae)* and two glorious patches of *Thelymitra venosa*, the Veined Sun-orchid (each in a sphagnum bog patch) consisting of a few sky blue flowers, veined with dark blue. We also identified the Seseli *(Gingidia algens)* which had parsnip-like leaves, and the fruits of which smelled strongly of aniseed when crushed.

Young spotted trout (Galaxis sp.) in the mountain streams were observed snapping grasshoppers which landed on the surface of the water, and *Prasophyllum alpinum* specimens growing in the shade had a distinct perfume. The National Park Rangers had told us that the Ravens *(Corvus coronoides)* being aggressive, large and territorial had multiplied and spread throughout the park, and smaller native birds were retreating and diminishing in numbers.

On Saturday, 24th January, we drove southwest down the Alpine Way to Tom Groggin then north, descending steeply to Swampy Plain River. The Snow Gums were left behind and we entered a Woolly Butt *(E. delegatensis)* forest, and later Peppermints and Swamp Gums.

We detoured into the Murray No. 1 Power Station, which is an emergency power station capable of producing 150,000 Megawatts of electricity from water pressure conveyed one mile down a precipitous hill in enormous pipes to the turbines below. This colossal station with 10 turbines was under the control of one man.

As we reached Khancoban, both enormous front tyres on the bus exploded. The second punctured after the bus had stopped beside the public gardens where we had lunch in the shade of Spruce and other trees and waited for new tyres to arrive from Corryong, 27 Km. west. Eventually, we reached Corryong at 3 p.m., the heat was intense, over 40°C. and many of us enjoyed the pool at the Motel.

On 25th January we journeyed west through Cudgewa, Koetong, and Tallangatta. The water in the Hume Weir had receded so much with the drought that cattle were grazing on land exposed under the dead trees which formerly had been drowned by water. Pelicans were abundant, Coot and several species of Duck, Ibis, Herons, Emus and a Whistling Eagle, Black shouldered Kite, and Red-rumped Grass Parrots were seen, also Eastern Rosellas, flocks of Corellas, Spoonbills, Egrets and Plovers were all visitors to the flats around the Weir.

We joined the Hume Highway at Wodonga, and reached Melbourne around 4 p.m. The temperature was 35 C.

* c/- Royal Children's Hospital, Parkville

"A Field Guide to Nests & Eggs of Australian Birds" BY GORDON BERULDSEN

Rigby Publishers Limited, 1980. Adelaide: Pp.448 + col. pl1. 63, 183 mm x 125 mm. $16.95.

When Alfred Newton of Cambridge, a founder of the British Ornithologists' Union, wrote disappointedly of eggs as a source of benefit for systematic ornithology[1] he unintentionally did a disservice to one branch of his science. It was not that he was necessarily wrong but rather that the lasting effect of his comment, perfectly just in context, tended to debase the study of eggs in general. This effect was later carried even farther, for other reasons, by the considerable anti-collecting swing of the early mid-twentieth century. Yet the study of nests and eggs provides a great deal of fundamentally important information on various points; — breeding distribution, nest construction, range of variation in nest site and material, range of clutch size, egg colour variation etc, and it is right to add Newton's further comment that he yielded "to none in his high estimate of its (bird-nesting's) utility in acquainting the learner with the most interesting details of bird-life — . . ."

The last serious works on Zoology of Australian birds were Campbell's and North's — still basic and valuable references. Campbell was a pioneering field worker and egg collector whose book is an essential historical source of data. North, a museum ornithologist added splendid species-descriptions to his similarly valuable historical account of eggs. Apart from the very useful descriptions of nests and eggs in Cayley's "What Bird is That?", in Graham Pizzey's "Field Guide" and in books dealing with particular groups, e.g. Frith's "Birds in the Australian High Country", nothing substantial on the subject has appeared in many years.

Against this background welcome to Gordon Beruldsen's valuable book. First, and extremely important, it rightly renounces not only egg collecting but also the touching of eggs in a nest and the keeping of parent birds away from the nest. This is not only a legal matter but also, for many people a moral one and it is true that the nest, indirectly, and the eggs and young directly, represent the most vulnerable stage in the life-cycle of a bird species. Many will also agree that the view of the bird's nest and eggs is an intimate privilege in nature not to be taken lightly. No one ought to feel therefore that this book will initiate a spate of egg collecting by young naturalists and perhaps this aspect ought to be briefly discussed and advice offered to them. There is no question about it — collection of the eggs of protected native birds, and they are almost all protected, is a legal offence and is punishable by law. It must not be done and every opportunity must be taken to stress this. On the other hand bird-nesting, the finding of nests and climbing to them is a healthy enough activity for boys, and some girls, and it was once considered a healthy field sport for men, and as far as that goes, it is. There is no doubt that it can be the means of gaining a close and lasting knowledge of birds, their habits, and their nests and eggs. However the advice offered is this — if you are not prepared to take the trouble to take and preserve notes on the nests and eggs you see, as well as being careful not to touch them (unless it is known that the species is not sensitive to the eggs being handled) and not to derange the nest or keep the birds away too long, and if you are not prepared to make your notes available to others later for ornithological knowledge and for conservation of the species — then keep away from nests and eggs; you don't belong there. The taking of notes and the keeping of these rules are the cost of the privilege of seeing. Remember too that mammal and bird predators are ever alert to the movements of humans, especially if these movements reveal birds' nests previously unknown to the predator, therefore avoid examining nests within their view.

Now to the book. It is substantial, well-produced and divided into three sections. Part 1 provides explanation, general information and a note on conservation. Part 2 presents the coloured plates of nests in the field and of eggs with keys to the identification of both. Part 3 contains the descriptive

text for each species giving species names, distribution, breeding range, nesting season, breeding frequency, nest description and egg description including clutch size.

There are 32 photographs, all but one in colour, of the nests of different species and 48 coloured plates of eggs of over 400 species. Over 500 species are described in the text. Happily the eggs of introduced species are included though unfortunately not illustrated. The General Information includes useful comment on Colony Breeding, Predation and Parasitism. The coloured photographs of the nests in the field, often revealing the eggs they contain, are excellent. The keys to the nests, based on site, shape, structure and material are generally sound and very useful providing their necessarily broad approach is appreciated. Nevertheless they are not ideal — the nest of the Gull and the Pipit hardly have any real affinity though artificially falling in the same category here. The publisher's attention is drawn to the need for a comprehensive guide to nests based on line drawings and photographs that will at once show the nest types of species groups and the wide range of variation that can exist in the nests of particular species while also facilitating identification. The nest Collection at the National Museum of Victoria would be available for study for such a work.

The plates of the eggs are a main feature of the book and generally they are reasonably well-produced and serve their purpose well enough but one has to say that some, especially those of smaller eggs, are not as sharp, and not as free of shadows as they deserve to be considering their purpose, their importance and their potential attractiveness. In some instances their colour tends to be a little yellowish and the eggs of the ravens are rather paler and duller than is so in life. Some form of size scale on each plate would have been most useful and some means of numbering the clutches would have provided quick reference to species names in the plate legend. On plate 113 it would seem that egg C represents the "Elongated oval" shape and egg F the "Tapered oval (typical egg shape)" not as is stated on the plate. The inclusion somewhere of a sample range of incubation periods of birds of various sizes and groups would have been useful. For the serious student it would have been helpful to give an indication of the number of eggs, or the references, upon which the average egg size is based.

The text is generally excellent and the book is literally full of good information compiled by a dedicated field observer e.g. the details given for the Brown Hawk, the distraction display of the Dollarbird and many other comments. There are also the points one expects to find e.g. reference to the dry leaves in the lining of the Yellow-Robin's nest and the inward curve of the rim of the Little Grassbird's nest. Some common points however are unexpectedly not mentioned e.g. the ramp of trampled reeds often leading to the Coot's nest, the occasional nesting association of the Willie Wagtail with the Magpie-lark and its liking for dead branches sometimes over water, and the frequent use of sheep's wool by the White-plumed Honeyeater. The attempt to avoid repetition in describing species' eggs sometimes becomes clumsy in another direction e.g. the eggs of the Yellow-tufted Honeyeater are said to be like those of the Yellow-throated, that are said to be like those of the White-eared that are said to be like those of the Purple-gaped — that are described! The shape of the eggs of all the owls is given as round but this is not so for the owls of family Tytonidae in which the eggs are distinctly longer than they are wide. It may be noted also that the Eastern Rosella sometimes nests in holes in sandbanks. (*Emu* 54.118)

Regardless of these minor points this is a splendid book that will fill a very real need. An equally important point however is that it is a very significant book that could well stand at the beginning of a new era in the study of nests and eggs. This study has for years been much neglected because of the disrepute into which egg collecting fell when it was still legal and by desuetude when it became illegal. With it went, from the body of bird-watchers, a certain amount of general lore on eggs, nests, and nesting habits and in its place came a sense of guilt to accompany any interest in eggs.

The author of the book in his "Introduction" shows his awareness of the historical position of his work. I wonder, however, whether either the author or publisher has fully considered the potential of the book and the opportunity it presents to capture the imagination of the young and to impressively present, for the close of the 20th century, a set of ideals that, although they are certainly not new are nevertheless new when you are a fourteen year old reader. I mean "a look and take notes but don't touch" ideal; an ideal of

responsiveness to the fascination (for some), and to the beauty, of a nest of eggs coupled with a real respect for the bird's needs. On the other hand perhaps the decision not to go as far as this has been both a conscious and a wiser one than the approach just suggested.

The prominent and explicit warnings against touching and collecting eggs printed at the front are at present no doubt still necessary — yet they are negative; they preserve the present tradition without presenting a positive alternative. The real question is whether it is better to adopt an attitude of providing a needed book of information while preserving the *status quo* knowing that there will always be a few boys with illegal boot-box egg-collections doing limited harm, or to initiate and encourage a wider interest within positive guide-lines. A book on birds' eggs has been long overdue and this is a good one but there is need to consider which line is the better one to take. My choice would be to have faith in young people providing one gives them a sense of having something to collect that is worthwhile i.e. good field data to use for the conservation of the birds (the R.A.O.U. Nest Record scheme offers opportunity for putting data to good use), good field data for the use of posterity, and good field data to accompany their own memorable experience of field acquaintance with the nests and eggs of Australian birds.

A. R. McEvey,
Curator of Birds,
National Museum of Victoria.

1. Newton, Alfred. Assisted by Hans Gadow, "A Dictionary of Birds" London: 1893-1896. In essay under "Eggs". Still an excellent brief account of the subject.

"The author of this work is seeking an artist to assist in preparing future works. Please contact G. R. Beruldsea, 18 Cohen St., Kenmore, Q. 4069"'.

"Learning about Australian Birds"
BY ROSEMARY BALMFORD

22 cm x 14 cm, 240 pp including 15 colour plates. Collins, 1980. Hard cover. Recommended retail price $16.95.

This is a very readable book which will be useful in bridging the hiatus between casual observation and more formal bird study. The quthor repeatedly emphasizes the relative lack of information on most facets of Australian birdlife and the place for contributions from the dedicated amateur. Her chapters entitled 'What to watch for', 'What to record', 'Studying birds in the field' and 'Research' should aid the reader to formulate problems and devise methodology appropriate for their solution. References for further reading related to each chapter and regional organizations concerned with bird study are listed at the end of the book.

The major weakness of this book stems from its attempt to address the full range of experience of potential readers — from the novice to the aspiring author. Much of the material on field identification could better have been left to other sources, most notably the verbal descriptions of characteristics of major bird groups. Similarly, those setting out for remote areas will need to know considerably more than what is covered in the chapter entitled 'Expeditions and holidays'.

Such criticisms aside, this book hopefully will motivate readers to undertake and communicate the results of individual studies, as well as to contribute to ongoing projects of larger scale.

F. D. PANETTA

Proceedings of the Melbourne Herpetological Symposium
EDITED BY
C. B. BANKS AND A. A. MARTIN

(Proceedings of the Melbourne Herpetological Symposium held at The Royal Melbourne Zoological Gardens, Victoria, Australia. May, 1980. Eds. C. B. Banks and A. A. Martin. Zoological Board of Victoria. Available from Symposium Secretary, The Royal Melbourne Zoological Gardens, P.O. Box 74, Parkville, Vic. 3052. Price $12.00, including postage. Cheques should be made payable to "Zoological Board of Victoria").

A collection of 35 papers and expanded abstracts covering Australian frogs and lizards, venom research, tortoises and turtles, and Australian crocodiles. Further papers discuss such topics as reptile diseases, herpetological communities, conservation and taxonomic studies. Many noted herpetologists are represented.

Field Naturalist Club of Victoria

Reports of recent activities

General Meeting
Monday 15 June

Instead of a speaker there was a film on the need to conserve our forests. It was a case of preaching to the converted and perhaps that was fortunate as the unconverted would be unlikely to sit through such wordiness and chopped up picture sequences. Included were some frightening shots of large trees being reduced to chips.

Exhibits and Nature Notes. There were several slides of rotifers under microscopes; one of the slides dated from last century, being made by Sheppard who described the species in 1898. Also under microscopes were some living hydras — slender stalks with several projecting arms at the end like a star, and some desmids — transparent green threads with a fine pattern.

Several land snails of the family Caryodidae, endemic to Australia, included Australia's largest *Hedleyella falconeri* about 8cm (3") from NSW and Queensland, and Victoria's largest — *Pygmipanda atomata* about 5cm (2"); this was shaped like the marine Pheasant Shell but was brown in colour.

A large bony structure was the jaw of a wombat, and an Australian Onthaphagus beetle about 2cm long (¾") showed the shovel feet characteristic of dung beetles.

A member reported a bright yellow slime mould, a patch about 10 cm (4") across, that withdrew into the bark overnight. Another reported that the last of the Queensland fruit bats seem to have left the Botanic Gardens.

President Wendy Clark thanked contributors and urged more members to provide specimens and nature notes for much can be learned from them.

General Meeting
Monday 13 July

Mr Ros Garnet was presented with honorary membership of this Club.

In making the presentation, Dr J. H. Willis spoke of Mr Garnet's wide-ranging activities in the cause of natural history and conservation. Prior to joining FNCV, three articles by Ros Garnet had been published in the *Victorian Naturalist* and, by 1970, 107 Garnet items had appeared in our journal including a series of 19 articles on National Parks in 1960-61. He has published a book on Wilsons Promontory and Wyperfeld, each illustrated by his own photos and line drawings, and a book on Venomous Australian Animals for the Commonwealth Serum Laboratories.

Dr Willis reported that Ros Garnet has been secretary, vice-president and president of this Club; he was a founding member of the National Parks Association, being secretary for more than 20 years, and he was a driving force in creating the National Parks Authority. For many years Mr Garnet was on the management committee of Wilsons Promontory and of Wyperfeld. In 1966 he was awarded the Natural History Medallion.

Speaker for the evening was Mr Ros Garnet on "Reminiscences of a Naturalist". He entertained us with accounts of early incidents and FNCV members, how he became increasingly involved with activities of this Club and in efforts for national parks. He ended with a pertinent nonsense rhyme and a song sung with a fine resonant voice.

Exhibits and Nature Notes. There was an entire bench of memorabilia displayed by Ros Garnet. Included were his first record of interest in natural history — a certificate of membership in the Gould League of Bird Lovers at the age of 8, photo album of early FNCV

The Victorian Naturalist

The Magazine of the
FIELD NATURALISTS CLUB OF VICTORIA

in which is incorporated
THE MICROSCOPICAL SOCIETY OF VICTORIA

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COMPILED BY KEN N. BELL

JENKIN BUXTON PRINTERS PTY. LTD.
1-13 Abbotsford Street, West Melbourne, 3003

PLANTS

REPTILES

SPIDERS

excursions, 22" leaf of Mountain Grey Gum *Eucalyptus cypellocarpa,* and much more.

Under the microscope were some living aquatic earthworms — short, white and segmented, and some protozoans like translucent white pears.

Provided with a large hand lens for better viewing were three introduced slaters — Beaded Slater *Porcella scaber,* Smooth Woodlouse *P. laevis* (probably the most common) and Butcher-boy *Armadillidium vulgare;* each was about 1cm long.

Flowers of Myrtaceae family were queried as a species of *Agonis* — ball-like 12mm cluster of small fruits with a few 6mm white flowers at the top.

A member reported groups of 30 or more Blackbirds and asked if that is usual. Another reported flocks of several hundred Mynahs. Two Gang Gangs were seen in East Hawthorn, and one member remarked how lovely it was to hear Currawongs and asked where do they go in summer; to the mountains was suggested.

A member reported on the invincibility of a rock-fern she was growing; twice it had been completely defoliated by snails but survived.

OAM to Sister Enid Bowman. Many years secretary of the Victorian branch of SGAP, Sister Bowman has been honoured with the Order of Australia Medal.

To All Naturalists

LAND USE POLICY

The Federal Government is holding a standing committee on LAND USE POLICY and is inviting all interested persons or groups to make submissions.

The current political climate is swinging away from consideration of conservation. The catch cry is "Development at any cost".

This standing committee is an excellent opportunity to exert some influence on the direction Australia is heading.

The FNCV is organising a submission to the hearing and we would like to incorporate information that you could provide.

We are collecting information on :

1. Alterations in habitat, particularly bush and swamp and vegetation clearance.
2. Effect of the above on wildlife.
3. Factors responsible for that loss.
4. Improvements to the legislation and administration which would overcome the above.
5. Any other issues you feel are important.

Please send all information to Wendy Clark, 27 Rangeview Avenue, North Balwyn, 3104, by *19th September 1981.* For additional information ring Wendy on 859 8091 ah. 377 2336 bh or Malcolm Turner 877 2835 ah.

Syllabus (Geology Group)

Wednesday, 1 July. Quantitative Approaches to Graptolite Environments in Central Victoria. Part II. Speaker: Dr Noel Schleiger.

Wednesday, 5 August. New Classification of Rocks. Speaker: Mrs Gabi Love.

Wednesday, 2 September. Slide Night.

Wednesday, 7 October. Granites of Wilson's Promontory. Speaker: Mr Gary Wallis.

Wednesday, 4 November. To be announced.

Wednesday, 2 December. Xmas members night.

Excursions. 7-8 November.

Week-end excursion to Wilson's Promontory. Leader: Mr Gary Wallis.

Field Naturalists Club of Victoria

Established 1880

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 Honorable SIR HENRY WINNEKE, KCMG, KCVO, OBE, KStJ, QC.

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Microscopical: Mr. M. H. MEYER, 36 Milroy Street, East Brighton (596 3268)
Entomology and Marine Biology: Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)
FNCV Kinglake Nature Reserve: McMahons Road, Kinglake.
Bookings and keys: Mr. I. F. MORRISON, 788 Elgar Road, Doncaster (848 1194)

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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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FNCV DIARY OF COMING EVENTS

GENERAL MEETINGS

At the National Herbarium, the Domain, South Yarra.

Monday, 12 October, 8.00 p.m.

Aspects of the environmental impact statement in relation to the East Gippsland woodchip industry. Speaker: Dr Brian Smith. Honorary Membership will be awarded to Miss Ruth Clarke.

Monday, 9 November, 8.00 p.m.

Presentation of the Australian Natural History Medallion Award. The Medallion address will be given by the winner, Dr Elizabeth Marks, on "Natural history of mosquitoes".

Monday, 14 December, 8.00 p.m.

Meeting to be hosted by the Hawthorn Juniors.

New Members — September/October General Meetings.

Ordinary

Lori Eddington, 1/470 Brunswick Rd, West Brunswick.
Beth Elkins, 11/156A Napier St, Essendon.
Peter Evans, 51 Woodleigh Cres., South Vermont.
Richard Faragher, 4 Grange Ave, Canterbury.
Ellie Hamilton, 9 Aintree St, East Brunswick.
Alison Hilton, 16 Dawson Ave, Elwood.
John Kosky, 111 Lawrence Rd, Mt Waverley.
Eunice Leonard, 9/20 Denmark Hill Rd, Hawthorn East.
Dianna McClellan, 3 The Boulevard, North Balwyn.
Vicki Paris, 82 Trevallyan St, South Caulfield.
Elizabeth Powell, 22 Davison St, Richmond.
Bruce Thorley, 34 Regent St, Burwood.

Joint

Robert and Nancy Davidson, 32 Chapman Ave, Glenroy.
Alan and Gail Holmes, 81 Newry St, North Fitzroy.
Mary and Harry Hunt, 'Happy Sparrows', Pakenham Upper.
Tim and Denise McCartin, 19 Marco Polo St, Essendon.

Country

Doug Binns, P.O. Box 273, Eden.
Isobel Brinsden, Box 112, Merbein.

FNCV EXCURSIONS

Tuesday, 3 November. Club picnic to Chambers Park. Leaders: Mr and Mrs D. Dunn. Coach will leave Batman Ave at 9.30 a.m. Fare $6.00. Bring a picnic lunch. Members coming by car should meet at 10.45 a.m. at Emerald Hall, on the corner of the road to Emerald Lake.

Sunday, 6 December. Mt Worth. Leader: Miss Wendy Clarke. Coach will leave Batman Ave at 9.30 a.m. Fare $7.00. Bring 2 meals.

Preliminary notices:

Saturday, 16 — Friday, 22 January. Portland. This will be hosted by the Portland Field Naturalists Club. The costs will be $220 for the fare and DBB accommodation in a motel. A deposit of $20 should be paid to the Excursions Secretary when booking and the balance by the December General Meeting. Day trips will depend on the season but will probably include Cape Nelson, Mt Richmond National Park and Kentbruck Heath. Coach will leave Flinders St from outside the Gas and Fuel at 8.00 a.m. Bring a picnic lunch.

GROUP MEETINGS

FNCV members are invited to attend any Group meeting, no extra charge.

Day Group — Third Thursday.

Thursday, 15 October. Yarran Dheran Reserve, Mitcham. (Melway map 49 B6.) Meet at entrance gate, Ashburton Drive, at 11.30 a.m. Cars will meet 10.30 a.m. train from Flinders St (Lilydale) at Mitcham station. Leader: G. Taylor (878 3415).

Thursday, 19 November. Jell's Park, Glen Waverley. (Melway map 71 K6.) Meet at 11.30 a.m. near car park. Cars will meet 10.25 a.m. train from Flinders St at Glen Waverley station. Leader: D. McInnes (211 2427).

December — no meeting.

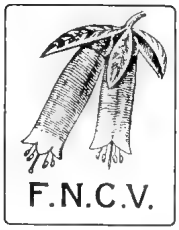
At the National Herbarium, the Domain, South Yarra, at 8.00 p.m.

First Tuesday — Mammal Survey Group.

Tuesday, 6 October. Bandicoots. Speaker: Peter Brown.

Wednesday, 28 November. Owls. Speaker: Ed McNabb. Please note date.

(continued on page 223)



The Victorian Naturalist

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Cover illustration: A view from Deal Island on East Cove, Murray Pass and Erith in the background.

The Inshore Fishes of the Kent Group in Bass Strait

By Rudie H. Kuiter*

The Kent Group (39°29′S, 147°20′E) lies between Wilson's Promontory and Flinders Island in the shallow waters of Bass Strait. It consists of three main Islands of which Deal Island, about 5½ km long is the largest. The other two, Erith and Dover Islands, which are close together and joined by an intertidal ridge are separated from Deal Island by a deep channel called Murray Pass. The channel is nearly one kilometre wide and about 45 metres deep in the middle. Strong tidal currents, up to 2½ knots, run here. The shores are rocky, except for the upper parts of the coves, which have sandy beaches.

Between March 22 and 29, 1981 a variety of habitats in ten different locations around the Islands were surveyed. Observations were made mostly to depths of 25 metres, with the exception of one dive to 35 metres in Murray Pass. One dive was made after dark. Nearly half the number of fish species observed were photographed as well. Visibility during the dives averaged about 20 metres.

The surroundings of the Kent Group consist of vast areas of sand with a mean depth of about 30 metres. The sand in the vicinity of the islands is bare and wave shaped, indicating a regular turnover caused by the big seas so notorious for Bass Strait. Because of the sand barrier the island group is an isolated place for reef-dwelling fishes. However many species have pelagic young and are carried by currents from other places making this region particularly interesting from a distributional point of view. Habitats vary between the exposed areas and the protected areas in Murray Pass, but the general scene is algae and kelp down to 15 to 25 metres. In the exposed areas kelp covers the rocks down to the sand. In most places reefs are composed of large boulders sloping often steeply down to the sand. They create lots of caves and ledges with a rich growth of invertebrates. In Murray Pass the kelp is replaced at about 20 metres by red algaes, caulerpaes and a tremendous variety of sponges and ascidians. Seagrasses cover most of the sandy areas in the coves, especially in Murray Pass.

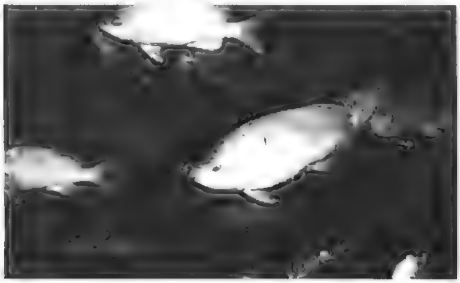
A total of 68 species in 33 families of fishes were recorded during the dives. The leatherjackets were best represented with 9 species, followed by the wrasses with 7. The most common species were the Barber Perch on shallow to deep reefs and the Butterfly Perch on deep reefs, where they occurred in dense schools. Several species of wrasses were also common, particularly the Yellow-saddled wrasse which occurred in aggregations in kelp areas.

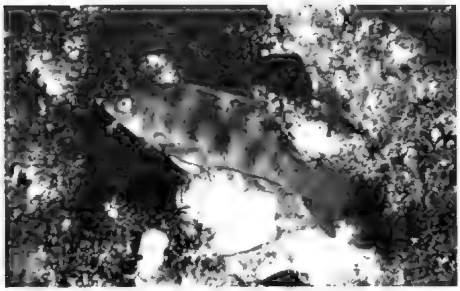
The least common wrasse, the Snakeskin wrasse was only found in depths greater than 20 metres. None of the species of leatherjackets appeared very common, despite their diversity, although representatives of all sizes were observed. Species of particular interest were species which occur primarily in N.S.W. These are the One-spot Puller and Mado, which occurred commonly in both juvenile and adult stages. The White-ear outnumbered the Scaly-fin by far, a situation opposite from that in Victoria, while the Halfbanded Perch, a species not recorded from Victoria occurred reasonably common in depths of about 20 metres. This species is very

* P.O. Box 124, Seaford, Vic. 3198.

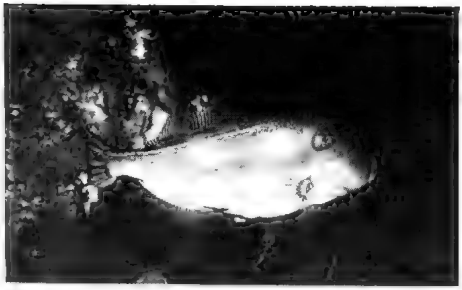
common in southern N.S.W. and probably does occur in eastern Victoria as well. Another primarily N.S.W. species, the Black Drummer, was found in schools over algae covered boulders in the intertidal zone of some coves. The sand and seagrass areas were almost exclusively populated by the Silver Belly and Goatfish, although a few species of ray, several Port Jackson Sharks, an Angel Shark and a Flathead were observed in the area as well. In addition some Sand-gobies and small schools of False-eyed Weed-whitings were seen close to reefs. None of the pipefishes or seahorses (family Syngnathidae) could be found, although the habitat seems ideal and the family is well represented in Victoria. All species observed are well known from the mainland, with the exception of the Southern leatherjacket, which is uncommon in Victoria, but common in Tasmania. Generally most species, with the exception of a few sand dwelling ones, appear to be established and are reasonably common.

Fig.1
Some fishes photographed in the Kent Group
a Barber Perch, *Caesioperca rasor*





b Yellow-saddled wrasse, *Notolabrus fucicola*



c Southern leatherjacket, *Meuschenia australis*
d Snake-skin wrasse, *Eupetrichthys angustipes*

e Long-snouted Boarfish, *Pentaceropsis recurvirostris*
f Mado, *Atypichthys strigatus*

g Southern Gurnet-perch, *Neosebastes scorpaenoides*

Class CHONDRICHTHYES (Cartilaginous Fishes)
Subclass ELASMOBRANCHII (Sharks and Rays)
Family HETERODONTIDAE (Bullhead Sharks)
Port Jackson Shark, *Heterodontus portusjacksoni* (Meyer), 1793

Family SQUATINIDAE (Angel Sharks)
Angel Shark, *Squatina australis* Regan, 1906

Family RHINOBATIDAE (Shovelnose Rays)
Banks' Shovelnose Ray, *Aptychotrema rostrata* (Shaw and Nodder), 1794

Family DASYATIDAE (Stingrays)
Smooth Stingray, *Dasyatis brevicaudata* (Hutton), 1875

Family MYLIOBATIDAE (Eagle- or Bullrays)
Southern Eagle Ray, *Myliobatis australis* Macleay, 1881

Class OSTEICHTHYES (Bony Fishes)
Subclass ACTINOPTERYGII
Superorder TELEOSTEI
Family AULOPIDAE (Sergeant Bakers)
Sergeant Baker, *Aulopus purpurissatus* (Richardson), 1843

Family PEGASIDAE (Sea Moths)
Sculptured Sea Moth, *Acanthopegasus lancifer* (Kaup), 1861

Family MORIDAE (Cods)
Bearded Rock Cod, *Physiculus barbatus* (Guenther), 1863

Family ATHERINIDAE (Hardyheads)
Small-mouthed Hardyhead, *Atherinasoma microstoma?* (Guenther), 1861
Hardyhead, *Atherinasoma* sp.
Ogilby's Hardyhead, *Pranesus ogilbyi* Whitley, 1930

Family DINOLESTIDAE (Long Finned Pike)
Long Finned Pike, *Dinolestis lewini* (Griffith), 1834

Family APOGONIDAE (Cardinal fishes)
Southern Cardinal, *Apogon conspersus* Klunzinger, 1872

Family SERRANIDAE (Sea-Perches)
Half-banded Sea-Perch, *Ellerkeldia maccullochi* Whitley, 1929
Butterfly Perch, *Caesioperca lepidoptera* (Bloch and Schneider), 1801
Barber Perch, *Caesioperca rasor* (Richardson), 1839

Family PLESIOPIDAE (Devil- and Hulafishes)
Southern Hulafish, *Trachinops caudimaculatus* McCoy, 1890

Family GERRIDAE (Silverbellies)
Silverbelly, *Parequula melbournensis* (Castelnau), 1872

Family MULLIDAE (Goatfishes)
Red Mullet, *Upeneichthys lineatus* (Bloch and Schneider), 1801

Family PEMPHERIDAE (Bulls eyes)
Common Bulls eye, *Pempheris multiradiata* Klunzinger, 1879

Family SCORPIDIDAE (Sweep and Mado)
Mado, *Atypichthys strigatus* (Guenther), 1860
Sea Sweep, *Scorpis aequipinnis* Richardson, 1848

Family KYPHOSIDAE (Drummers)
Zebra fish, *Girella zebra* (Richardson), 1846
Black Drummer, *Girella elevata* Macleay, 1881

Family ENOPLOSIDAE (Old Wifes)
Old Wife, *Enoplosus armatus* (White), 1790

Family HISTIOPTERIDAE (Boarfishes)
Long-snouted Boarfish, *Pentaceropsis recurvirostris* (Richardson), 1845

Family APLODACTYLIDAE (Sea Carp)
Sea Carp, *Dactylosargus arctidens* (Richardson), 1839

Family CHEILODACTYLIDAE (Morwongs)
Jackass Morwong, *Nemadactylus macropterus* (Bloch and Schneider), 1801
Banded Morwong, *Cheilodactylus spectabilis* Hutton, 1872
Magpie Perch, *Cheilodactylus (Goniistius) nigripes* (Richardson), 1850

Family LATRIDAE (Trumpeters)
Bastard Trumpeter, *Latridopsis forsteri* (Castelnau), 1872

Family POMACENTRIDAE (Damselfishes)
One-spot Puller, *Chromis hypsilepis* (Guenther), 1867
White-ear, *Parma microlepis* Guenther, 1862
Scaly-fin, *Parma victoriae* (Guenther), 1863

Family LABRIDAE (Wrasses)
Maori wrasse, *Ophthalmolepis lineolatus* (Cuvier and Valenciennes), 1838
Snake-skin wrasse, *Eupetrichthys angustipes* Ramsy and Ogilby, 1888
Pretty Polly wrasse, *Dotalabrus aurantiacus* (Castelnau), 1872
Senator wrasse, *Pictilabrus laticlavius* (Richardson), 1839
Blue-throated wrasse, *Notolabrus tetricus* (Richardson), 1840

Yellow-saddled wrasse, *Notolabrus fucicola* (Richardson), 1849
Rosy wrasse, *Pseudolabrus (Lunolabrus) psittaculus* (Richardson), 1840

Family ODACIDAE (Cales and Weed-whitings)
Rainbow Cale, *Heteroscarus acroptilus* (Richardson), 1846
Herring Cale, *Olisthops cyanomelas* Richardson, 1850
Birdnose Weed-whiting, *Neoodax beddomei* (Johnston), 1885
False-eyed Weed-whiting, *Neoodax attenuatus* (Ogilby), 1897

Family TRIPTERYGIIDAE (Triple fins)
Macleay's triple fin, *Norfolkia macleayanus?* (Lucas), 1891
Rock triple fin, *Norfolkia* sp.
Weed triple fin, *Trianectes* sp.

Family CLINIDAE (Weedfishes)
Johnstons weedfish, *Heteroclinus johnstoni* (Saville-Kent), 1886
Wilson's weedfish, *Heteroclinus wilsoni* (Lucas), 1890
Coleman's weedfish, *Heteroclinus* n. sp.

Family GOBIIDAE (Gobies)
Kuiter's sandgoby, *Nesogobius* n. sp.
Sandgoby, *Nesogobius* sp.
Sculptured goby, *Callogobius mucosus* (Guenther), 1871

Family SCORPAENIDAE (Rock-cods and Gurnet perches)
Southern Rock-cod, *Scorpaena ergastulorum* Richardson, 1842
Spiny Gurnet perch, *Neosebastes scorpaenoides* Guichenot, 1867
Red Gurnet perch, *Helicolenus papillosus* (Bloch and Schneider), 1801

Family PLATYCEPHALIDAE (Flatheads)
Yellow Finned flathead, *Platycephalus speculator*

Family MONACANTHIDAE (Leatherjackets)
Six spined Leatherjacket, *Meuschenia freycineti* (Quoy and Gaimard), 1824
Horseshoe Leatherjacket, *Meuschenia hippocrepis* (Quoy and Gaimard), 1824
Southern Leatherjacket, *Meuschenia australis* (Donovan), 1824
Toothbrush Leatherjacket, *Penicipelta vittiger* (Castelnau), 1873
Mosaic Leatherjacket, *Eubalichthys mosaicus* (Ransay and Ogilby), 1886
Gunn's Leatherjacket, *Eubalichthys gunni* (Guenther)
Velvet Leatherjacket, *Parika scaber* (Forster), 1801
Rough-skin Leatherjacket, *Scobinichthys granulatus* (Shaw), 1790
Pigmy Leatherjacket, *Brachaluterus jacksonianus* (Quoy and Gaimard), 1824

Family DIODONTIDAE (Porcupine fishes)
Globe fish, *Diodon nicthemerus* Cuvier, 1818

Acknowledgements

I am grateful to the other participants, David Staples, Scoresby Sheperd, Jan Carey, Phillip Bock, Rhyllis Plant, Felix Wiedenmayer and master skipper Alan Cripps of the 'Polperro', for their assistance.

I would also like to thank Martin Gomon and Scoresby Sheperd for their valuable advice and reading the manuscript.

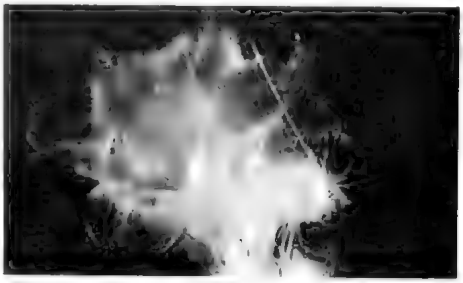


Fig. 2:
A tiny juvenile leatherjacket hitches a ride with a jelly, drifting along in the tidal currents. Many species of fish have pelagic stages and are dispersed in this way. It is likely that some species occurring in the Kent Group have originated that way, particularly the primarily NSW species.

The Effects of Introduced Animals and Plants in Australia.

A limited number of copies of the Proceedings of the above conference are available for $2 from Rob Wallis, Department of Environmental Studies, Rusden CAE, Clayton, Vic. 3168. Regarding the article "Introduced Mammals in Victoria" by H. Brunner, P. L. Stevens and J. R. Backholer (see *Victorian Naturalist 98:* 5-17), the authors wish to acknowledge that Evan Jones contributed much of the section dealing with feral cats. Full details of this work will be published soon in the scientific literature.

Potassium/Argon Age of Basalt in Floor of Hopkins River, Allansford, S.W. Victoria, Australia

BY EDMUND D. GILL*

Rivers have always been barriers to human movement. Rivers rive — they divide. Derivationally, a rival is a person on the other side of the river. Many political and social boundaries follow rivers. In Australian history many rivers have been barriers, and an example is the Hopkins River east of Warrnambool, Victoria. Before bridges were built, settlers found that they could ford the river at Allansford because of the hard substrate (a basalt flow) and because the banks were not too high. The property at this ford was owned by James McMahon Allan (Bonwick 1858) and so this site came to be known as Allansford.

Eruption Date of Basalt

At the Australian National University potassium-argon dates on this basalt were kindly assayed by Dr I. McDougall (Table 1). Some technical difficulty was experienced in determining these ages because of small amounts of calcite in the rock. It is thought that the age of the flow can best be expressed as 0.65 ± 0.06 m.y. The samples came from about 100 m south of the bridge on the main street of Allansford.

The basalt is thus appreciably younger than the Yangery Basalt forming the plain from north of Warrnambool to west of the Hopkins River at Allansford which was dated 1.95 m.y. (McDougall and Gill 1975). On the other hand it is older than the Sunnyside Calcarenite forming the east bank of the Hopkins River estuary north of the Hopkins Point Road bridge, which gave a uranium/thorium date of about 400 000 years (Gill and Amin 1975).

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Stratigraphy

The bedrock of the area is Port Campbell Limestone, an Upper Miocene calcareous silt laid down on the continental shelf. Where not stripped by erosion, it is covered by Hesse Clay (Gill 1965) as can be seen extensively in road cuttings north and east of Allansford. The areas nearer the coast so stripped may be due to the higher sea level that cut the 20 m platform in the Warrnambool Aeolianite whereon the business section of that city stands.

On the east side of the road running north from Allansford to Wangoom a quarry shows the Port Campbell limestone. It also outcrops on the west bank of the river just south of the Allansford bridge, where also there is a quarry. Opposite Jubilee Park it forms the high south bank west of Pool 5 (Fig. 1). At Warrnambool it forms the high cliff forming the west bank of the Hopkins River north of the Hopkins Point Road bridge.

The Basalt Flow and River History

The present rather zigzag course of the river was established before the basalt was extruded, and appears to be controlled by fundamental structures in the bedrock. There are essentially two directions (1) north-south which is the general direction of drainage, and (2) ESE-WNW which is parallel to the coast. The course of the river at the time of basalt eruption was different from now, but not very different. The deep pools shown in Fig. 1 are places where the river has excavated into the bedrock beside the basalt. At Pool 1 basalt outcrops to form the steep south bank of the river, which consists of 6+ m of

POTASSIUM-ARGON AGES ON BASALT FROM ALLANSFORD IN HOPKINS RIVER EAST OF WARRNAMBOOL, VICTORIA

Lab. No.	(wt. %)	Rad. ^{40}Ar (10^{-12}mol/g)	100 Rad ^{40}Ar / Total ^{40}Ar	Calculated Age (m.y.) ± 2 s.d.
77-15	1.310, 1.293	1.510	13.6	0.67 ± 0.03
77-16	1.285, 1.291	1.572 1.306	19.2 24.4	0.70 ± 0.03 0.58 ± 0.02

$\lambda_e = 0.581 \times 10^{-10} y^{-1}$ $\lambda_\beta = 4.962 \times 10^{-10} y^{-1}$ $^{40}K/K = 1.167 \times 10^{-4}$

Table 1

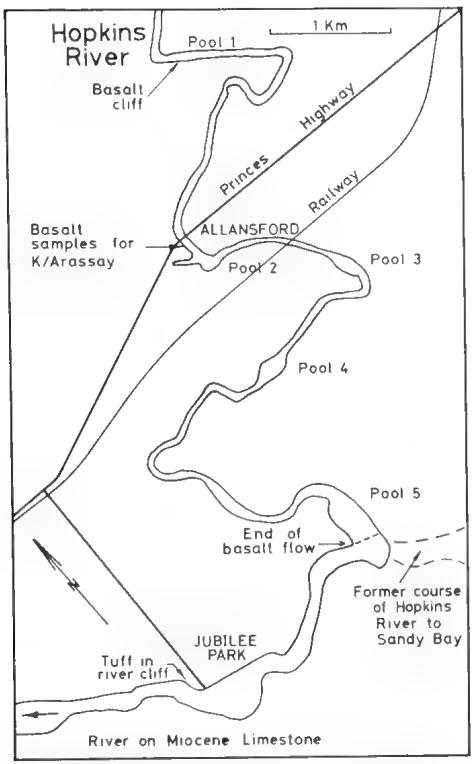

Fig. 1. The River Hopkins in the Allansford district.

basalt covered by 2 m of alluvium. The former river course is now partly under the river terraces. For example, just north of Pool 2 a small gully in the west bank marks the south edge of the basalt infilling the former river course. At Pool 4 the basalt margin cuts obliquely across the river; this edge is the former south bank of the river, the former course passing under the alluvium of the north bank.

The Allansford Basalt (as I suggest it be called) terminates at the east boundary of Jubilee Park, where it forms the north bank of the river. The Hopkins is tidal to Tooram Rocks, east of the park, where the lava flow last crosses the course of the present river. How far below sea level the base of the basalt lies is not known at present, but the fact that 0.65 m.y. ago the floor of the river was at least 4 m below present sea level over 9 km from the sea suggests a lower sea level. In fact, nearly all the basalt flows that cross the coast of S.W. Victoria occupy courses graded to lower sea levels. This prompts the question whether some

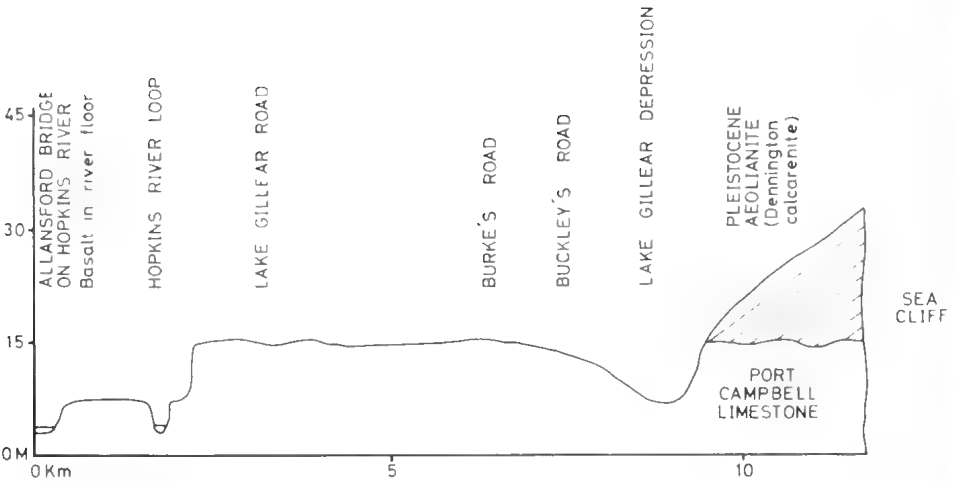

Fig. 2. Cross section from Allansford to the sea, showing the ridge that prevented a southerly course from Tooram Rocks to the ocean.

hydroisostatic factor is involved in the extrusion of these basalts, i.e. whether the lifting of the great weight of sea water off the continental shelf reduced pressure and encouraged eruptions. Tooram is 9.3 km from the mouth of the river, but apparently at no time did the river flow directly south from Tooram to the sea because a high ridge of bedrock limestone intervenes (Fig. 2).

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Sweet Bursaria — protection against sunburn

An FNCV member reported that the late Mr Arthur Swaby used to apply a solution from Sweet Bursaria *Bursaria spinosa* as a protection against sunburn.

Mr Swaby had a very practical method for convincing sceptics of its effectiveness. He boiled Bursaria leaves for several minutes, then bathed one forearm with the cooled solution, leaving the other arm untreated. At the end of a warm day in the field, the solution-covered arm was the same colour as before, but the other arm showed how burning the ultra-violet rays of a sunny day can be.

Intrigued by this report, another member decided to test it scientifically. About 1 cubic cm of Bursaria solution made with distilled water was placed in a quartz container and exposed to light of various wave lengths. All the ultra-violet rays were absorbed by the solution. (Quartz does not absorb ultra-violet rays as ordinary glass does but permits all rays to pass through it.) Then, as a control, the experiment was repeated using distilled water only; the ultra-violet rays were not absorbed by the water.

A biochemist surmised that the active ingredient was probably rutin.

M.J.L.

A Short History of the Discovery and Naming of Banksias in Eastern Australia

Part IV The Abbe Antonia Jose Cavanilles, Robert Brown, and Franz W. Sieber

BY A. I. SALKIN*

In March 1793 a Spanish expedition of exploration under the command of Allessandro Malaspina, whose avowed aims were geographical, zoological and botanical, sailed into Port Jackson (Burke, 1967). This expedition was one of many that were to be made in the next few years. The French had already funded the voyage of La Perouse (1785-88). This ill-fated voyage was the stimulus for a further French voyage to the Australian region of the South Seas, this was the voyage of Bruny d'Entrecasteaux (1791-94), the first rescue attempt in the history of ocean navigation. A further major expedition by the French was that of Baudin (1800-1804). Apart from the La Perouse expedition all other voyages had at least one botanist on board. The Spanish voyage was no exception, the botanist was Don Luis Nee, and in the region of Port Jackson and Parramatta, during the 27 days of the stay, he made a number of journeys. His observations of the colony are recorded in "Anales De Historia Natural No. 3" of March 1800 (Cavanilles, 1800). In the same issue Cavanilles described a number of *Banksia* spp. some of them, though collected earlier, not previously described. *B. serrata, B. integrifolia, B. ericifolia* and *B. spinulosa* were re-described and the first of the new species to be described was *B. microstachya,* this however is the juvenile foliage of *B. marginata.*

The second new species to be described was *Banksia oblongifolia.* The specimen collected is clearly correct but the height of twelve feet in the description is much too high; once again we have the problem of the botanist describing a species from a dried specimen and making unwarranted assumptions about heights or being misled by the collector.

The question of height becomes clearly absurd in the next species to be described.

"This tree towers majestically over the rest of the genus, and resembles the oak in size and nobility; some examples are thirty feet in height with one and half feet in diameter at the base . . . It grows in Botany Bay and in the town of Jackson. Observ. The carpenters of our expedition compare this tree with the oak, and from it they have made various boxes, which are preserved in the house of Mr Nee."

The species is given the name of *B. robur* and the herbarium specimen corresponds correctly with this species as does the rest of the description. It would appear that the description above pertains to either *B. serrata* or *B. integrifolia.*

The third and last new species to be described was *B. marginata.*

Like Smith, Cavanilles as well as giving a Latin diagnosis gives a popular description in Spanish —

"Banksia marginata

Banksia caule fruticosa; foliis linearibus, truncatis, margine revoluto; capsulis campiessis.

Shrub of four to five feet in height, whose wood is ashen red with veins the colour of cinnamon." (This appears to

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be an early attempt to use Wood as an aid in taxonomy.) "The bark dark and hairless when old, downy and ferruginous on the young branches. These divide various times, two, three or five coming from the same point and from its centre the inflorescence or cylindrical spike of flowers. All are covered with many stiff leaves supported by very short leaf stalks. They are linear, from one to two inches in length and two lines in width; green and hairless above white and somewhat downy on the underside, truncated at the point where the single longitudinal nerve projects and with the edges recurved. The spikes are two to three inches and are composed of downy scales of which the lower form a ruff and are pointed. The corollas are downy and deeply divided into four slender capillary lobes, some five lines in length, having the ends wider and concave enclosing a short filament and the anther. The cone is conical, covered with the hairlike styles of the flowers that have aborted, leaving visible between them a large number of little capsules, very compact, circular, wide in the anterior part, narrow and covered with a reddish fuzz on the posterior. They are fastened perpendicularly to the cylindrical receptacle and the wider surfaces are horizontal. The valves open towards the centre lengthwise, revealing the two compartments and the moveable diaphragm, half divided into two small fine blades; in each compartment there is a winged seed, smaller than in Banksia ericaefolia (sic). They grow on the road from Jackson to Parramatta, where the above mentioned Nee found them in flower and fruit. I believe that the fruit was of the past year."

Three other supposedly new *Banksia* spp. are described. *B. oleifolia* can be nothing other than *B. integrifolia* and *B. glauca* and B. salicifolia are synonymous with *B. oblongifolia*.

Robert Brown

Early in the 19th Century Matthew Flinders made a voyage of exploration that was remarkable for the precision and determination with which it was carried out (Flinders 1814, Mack 1966). What is even more remarkable is that unlike Cook he gave the botanist, Robert Brown, every possible opportunity to carry out the work that was to make Brown one of the most important botanists to visit Australia. Even before the ship had reached Port Jackson, Brown had collected some 750 species, over six hundred of which were new to science. Brown was no stranger to the botany of Australia. As Banks' collector he had seen all the material from Australia in the Banks Herbarium (Brown, 1814). He also appears to have been aware of Cavanilles' description of *B. marginata*, for the first eastern *Banksia* sp he collected at Bay X, near the present town of Port Lincoln, S.A. At first naming it *B. marginata*, he then appears to have had second thoughts and crossed out the first name and substituted *B. patula* his own name. Brown stayed in Australia until 1805 during which time he travelled extensively (Stearn, 1960). He was at the colony in Port Phillip just before Collins moved it to Tasmania and he spent time both at the Tamar and the Derwent settlements. Yet for all this exploration most of his names for eastern *Banksia* species are synonyms for banksias already described. Brown seems to have been aware of the variation within the various species. However, most of the differences that he perceived can be explained either by ontogeny, the difference between juvenile and adult foliage, or phenotypic response, the ability of plants to adapt within their lifetime to different environmental conditions. Only two eastern *Banksia* species have stood the test of time, of the ones he described from his visit; these are *B. collina* which is a variant of the *B. spinulosa* complex and *B. paludosa* which appears to be an intermediate between *B. integrifolia* and *B. aspleniifolia*. There is however still

no certainty that some of the variation that he was looking at particularly in *B. integrifolia* and *B. marginata* is not genetic, for there is little doubt that both these species exhibit, particularly in cultivation, differences that are not the result of the environment.

Brown's contribution in the *Banksia* taxonomy of eastern Australia was not so much in describing new species but in being able to discern, in the field, variation that raised questions about the fixed and enduring character of "the species".

Franz W. Sieber

Little has been written in English about Franz Sieber probably because he was not of that nationality or perhaps it was because he was a professional botanist who collected specimens of plants to sell. Audas (1950) gives him a short mention —

"One of the early botanical collectors, whose specimens are frequently mentioned in connection with those of Brown, was Francis W. Sieber, a native of Prague, Bohemia. He collected in New South Wales, and took large and excellent collections to Europe, which he sold in numbered sets bearing the labels "Florae Novae Hollandiae" and "Plants Exotic". Descriptions of many plants bearing his name as author are published in De Candolle's Prodomus (sic) and other works. It was he who discovered the curious but ornamental tree *Quintinia Sieberi,* frequently found growing out of the Dicksonia tree-fern."

Sieber spent only seven months during 1823 in Australia in the vicinity of Port Jackson and the Blue Mountains. One of his collections from New South Wales was a *Banksia* sp. which he named after a fellow collector who was working in the region at the same time; Banks' collector Alan Cunningham. One of the "sets" including *Banksia cunninghamii* is in the Kew Herbarium and bears the label "Fl Novae Holl. No. 6." Another label on the specimen notes that it is "*B. collina* R. Br. Flora Australiensis. Named by Mr Bentham." Bentham in his "Flora Australiensis" (1870) records a collection of Siebers and gives the number as six, the location he questions as Blue Mountains. He also records a specimen from Alan Cunningham, Western descent of Blue Mountains.

Brown in his "Proteaceae Novae" (1830) describes *B. cunninghamii* and gives dates, locations and the names of the collectors. The first of these is 1817, the mountains near Port Jackson, D. (sic) Cunningham." The second is "1825 Wilsons Promontory", the collector "D. Baxter".

It appears that while Bentham was not aware of the identity of these species, Brown was, and could perceive the relationship between the two.

Bentham had of course not been to Australia and perhaps because of the magnitude of his task he tended where possible to "lump" species together. The problem however was not one which could have been solved by the conventional methods of alpha taxonomy in a herbarium with only dried specimens. The problem is partly one of micro evolution that requires the techniques of experimental taxonomy involving the whole living plant.

There is no certain way of knowing if the specimin is in fact *B. cunninghamii* except by the phytoglyph method mentioned earlier (Part I). It does, however, bear a close resemblance to specimens I have collected and there is a strong likelihood that both Sieber and Cunningham were perceptive enough to recognize its dissimilarities to *B. collina.*

Apart from this there is the location of collections; both the Sieber and Cunningham collections came from the Blue Mountains where this species is localized and the Baxter collection from Wilsons Promontory is the closely related species, which Mueller later named *B. prionophylla* (Mueller, 1853) and Meissner described (Meissner 1854).

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Little Red Flying-foxes Collecting Water in Fur

BY RICHARD H. LOYN[1]

During a period of hot weather in January 1979 a flock of about 200 Little Red Flying-foxes *(Pteropus scapulatus)* was found roosting in 14m high River Red Gum *(Eucalyptus camaldulensis)* regrowth near Barmah Lake on the River Murray. At dusk the bats left the roost and began flying low over the water on a tributary creek, gliding and making loud splashes as they belly-flopped onto the surface. The heads were held high and did not touch the surface. By watching individual bats I could see that after doing this each would fly to a nearby tree, hang upside down and lick the water vigorously from the fur on its chest. I concluded that the function of this behaviour was to obtain water for drinking rather than washing as the bats did not appear to lick parts which had not already been wetted, and their movements suggested that they were swallowing substantial volumes of water.

It is well known that bats of many species fly low over water to obtain insects or water. However, I am not aware of any reports of collecting water in the belly fur. Troughton (1973) mentions that fruit-bats "drink regularly, usually while on the wing; lapping the water as they glide over its surface." Perhaps this is a mistaken interpretation of the belly-flopping method. However, I do not know if flying foxes use the method regularly or only on hot days. The temperature had reached 45°C on the day of observation (5.1.79) and the bats may have been under stress (and in need of extra water); three dead ones were found under the roost. The most obvious food source was the blossoms of River Red Gums which were flowering nearby.

Acknowledgement

I am grateful to Miss Joan Dixon and staff of the National Museum, Victoria for confirming identity of one of the dead bats.

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A Buried Soil at Mount Eccles, Western Victoria, and the Date of Eruption

By C. D. Ollier*

Mount Eccles is located about 8 km west of Macarthur in the Western District of Victoria. Mount Eccles itself is a rounded scoria cone, but there are many intriguing volcanic features in the vicinity including several small eruption centres, and large lava flows such as the Tyrendarra flow which flows south to the sea (Boutakoff 1963; Ollier 1964). The lava flows have disrupted drainage to form lateral streams, lakes and swamps, and volcanicity at Mount Napier to the north-east has had the same effect. Various attempts have been made in the past to work out a relative chronology of volcanoes, lava flows, river courses, and swamps, and more recently carbon dating has been used to provide absolute dates.

This paper describes a pre-Mount Eccles soil which contained roots yielding a further carbon date, and reviews the chronology of the area.

The salient features of the physiography are shown in Fig. 1. Mount Napier blocks a former drainage line that went from Buckleys Swamp, down the Harman Valley, and along the line of the Condah Swamp. Once created by volcanic damming, the swamp upstream of Napier would accumulate organic matter, and the oldest date of this should give a guide to the age of Mount Napier. A specimen collected by L. K. M. Elmore and dated by E. D. Gill gives a date of 7240 ± 140 y (Gill and Elmore, 1973).

Condah Swamp results from the damming of a stream by the lavas erupted from Mount Eccles, in the same way that Buckleys Swamp results from the eruption of Mount Napier. If the Condah Swamp was older than the Harman flow, basalt should overlie peat, but such relationships have not yet been found. Mapping by geomorphology students from Melbourne University in 1966 showed in fact that the peat of the northern part of the Condah Swamp overlies the Harman flow. This suggests that Mount Eccles is younger than Mount Napier.

The Tyrendarra lava flow followed an old drainage line along a prior Darlot Creek. Tributaries from the west were dammed back to form swamps and lakes (Lake Condah, Whittlebury Swamp, Homerton Swamp). North of Homerton the Darlot Creek runs along the western side of the lava flow as a lateral stream; at Homerton it crosses the lava flow and then runs along the eastern side of the lava flow as a lateral stream. South of Homerton Swamp the Fitzroy River comes in and runs along the western side of the flow. The lava flow therefore has twin lateral streams only south of Homerton Swamp.

To the east of the Tyrendarra flow there is less obvious disruption of drainage because there were no major tributaries here before the lava flow. Nevertheless a few swamps have formed by ponding by the Tyrendarra flow, including Woolsthorpe Swamp and a patch of swamp south east of Lake Condah (the lake, not the village of the same name). Basal peat from the latter has been dated (Gill and Gibbons, 1969) and gives an age of 6235 ± 120 y.

Gill (1979) describes a bore through the basalts of the Tyrendarra flow and into the underlying sediments. There appear to be two lava flows, one above the other, with a weathering horizon at the

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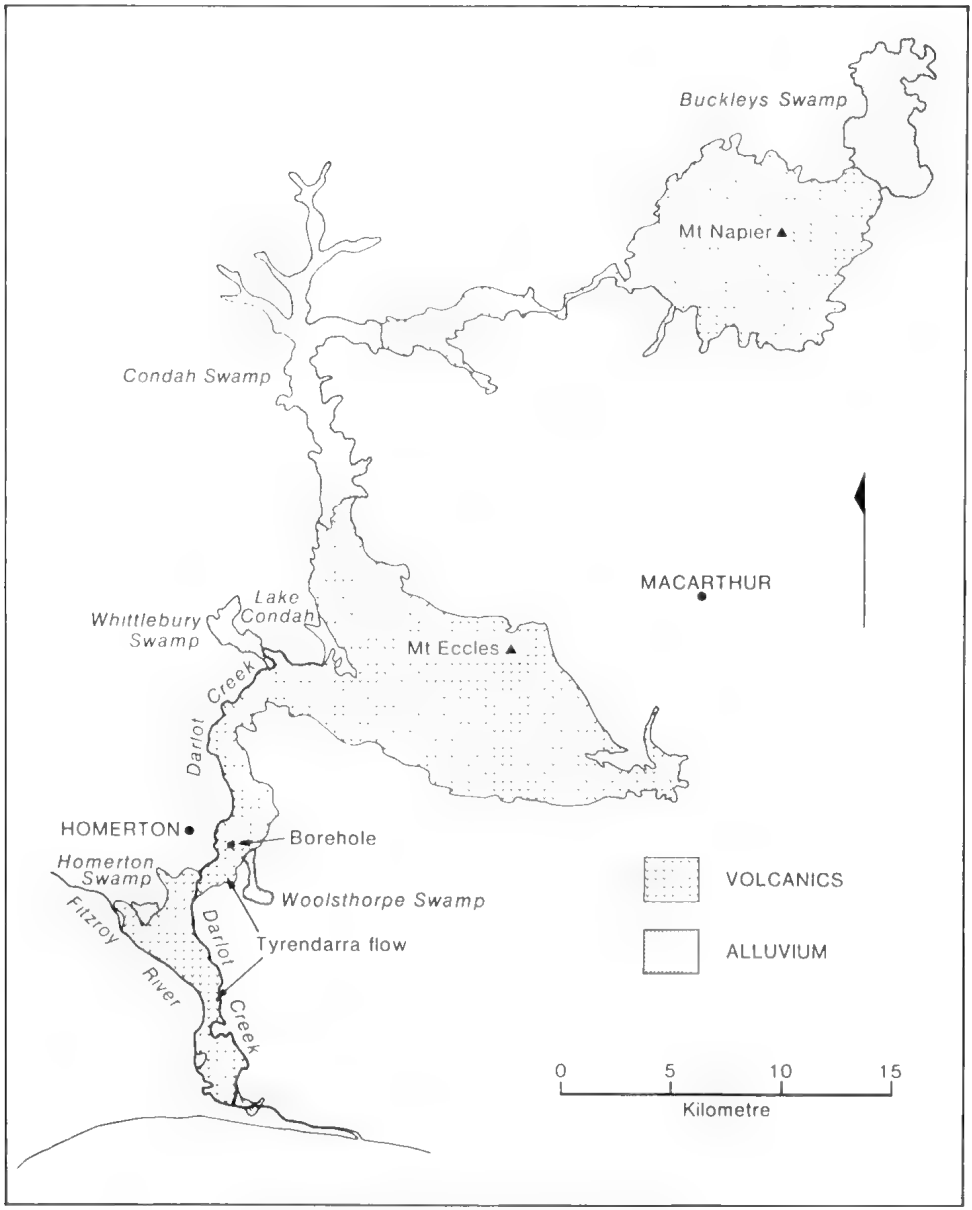

Fig. 1. Important physiographic features of the area.

top of the lower flow. This suggests two eruptions from Mount Eccles separated by a time interval sufficient for weathering — perhaps several thousand years. The underlying sediments consist of gravels, quite coarse considering the low gradient of the river at that time, and containing fossil wood. This has been carbon dated and Gill reports an age of 19,300 ± 600 years.

Mount Eccles Scoria Quarry

The large scoria quarry just outside the Mount Eccles National Park was ex-

Fig. 2. The Mt Eccles quarry, showing planar beds with some cross bedding.

cavated at one stage to the very base of the volcanics, revealing the underlying soil.

The volcanic sequence starts with very well stratified pyroclastic deposits containing much limestone from deep bedrock. There are planar beds and some cross bedding (Fig. 2), suggesting the base surge type of pyroclastic deposits commonly found around the maar-type volcanoes of Victoria. This sequence of thin-bedded pyroclastics is about 4 m thick, and is followed by pure scoria deposits, mostly black, in bands several metres thick. These gradually give way to very thick bands of red scoria (Fig. 3). This seems to be a typical Victorian volcanic sequence with a maar-type eruption at the start, followed by scoria eruption.

Beneath the volcanics is a brown soil with grey mottles and a small amount of buckshot. The soil has sub-angular to angular blocky structure and contains many roots, generally about 1 mm thick, which look remarkably fresh.

The soil is dark brown with occasional mottles and some ferruginous nodules which suggest some intermittent and temporary waterlogging at the time of soil genesis. The soil appears to be similar to the Prairie Soil profile (profile 14 B, p. 140) described in the Handbook of Australian Soils (Stace et al. 1968). That soil is formed on basalt in Western Victoria, but the soil beneath the tuffs at Mount Eccles is evidently from a mixed parent material, probably alluvium, for it contains quartz, feldspar, tourmaline, hornblende, zircon, rutile and xenotime as well as basalt fragments. Carbonate and phosphate minerals indicate little leaching and secondary mineral formation, and the hornblende suggests only weak to moderate weathering. The fresh looking roots might be explained by supposing that the basalt flow was hot enough to kill off microorganisms capable of decomposing organic matter, but not great enough to char the roots. Rather strangely, the absence of concentrated roots or phytoliths seems to in-

Fig. 3. Red scoria bands in the Mt Eccles quarry.

dicate the absence of topsoil, though it is hard to envisage any process that might remove the topsoil before volcanic eruption.

The soil contains pollen possibly indicating open eucalypt woodland. The majority of pollen belongs to Compositae. There is some eucalypt and *Casuarina* pollen, and the rest of the pollen belongs to grasses, *Grevillea*, *Haloragis* and *Beyeria*. There are some fern spores, and some cysts belonging to *Staurophyra elegans*.

The fresh looking roots were separated and dated in the Radiocarbon Dating Research Laboratory at the Australian National University, Reference number ANU-1680.

Henry Polach of the Radiocarbon Dating Research Laboratory at ANU notes (Pers. Comm.) "Low 14C activity of your sample combined with both relatively short counting time and small sample size do not allow us to define an absolute age error in conventional terms. However, the detected 14C activity places the radiometric age within the minimum age given and 52,000 BP with 95% probability, with an 'apparent' age of $28,750 \pm^{11,700}_{4,600}$BP." The minimum date is 19,750 BP.

There seem to be two possibilities to account for the various dates that have been derived from specimens in the vicinity of Mount Eccles.

Firstly there may have been simply one main eruption about 20,000 years ago, supported by the date reported here from the buried soil and the Tyrendarra flow date of Gill (1979), and the younger dates are spurious or require a more complex explanation than has so far been provided.

Secondly there may have been two periods of eruption. One about 20,000 years ago and the other about 7,000 years ago. This would account for the two older dates and also account for the two apparent flows in the borehole through the Tyrendarra lava flow, and for the very youthful features seen around the minor features south of

Mount Eccles such as quite unweathered irridescent lava stalactites around the Shaft (Ollier, 1964). It certainly seems that Mount Eccles itself, that is the large scoria cone, is older than Mount Napier. Little Mount Eccles and the upper part of the Tyrendarra flow could be younger.

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Naturalist Review

"Social Behaviour of Animals"

BY JOHN M. DEAG.

Studies in Biology Series, number 118. Edward Arnold, London. 1980. ISBN 0-7131-2770-8. RRP $9.60.

In what society is a female more genetically similar to her sisters than to her own offspring? The answer (and its theoretical basis) provides insight into how altruism could evolve in a number of societies. Alarm calls, soldier ants fighting to the death, adolescent female monkeys carrying and caring for their siblings — these kinds of altruistic acts have proved problems for biologists to explain how such behaviours could have evolved. The answer has been provided by sociobiologists and their theory of kin selection. By sacrificing yourself you might save sufficient of your kin that bear some of your genes. Hopefully this will include many of your relatives with the "altruistic characteristic".

The beauty of this little book is that in only 91 pages it manages to cover so many aspects of social behaviour without appearing to skimp too much. It is one of the excellent series of books sponsored by The Institute of Biology and it continues to maintain the already high standard we have come to expect from the Studies In Biology group.

The author bases his work on the adaptive significance and biological roots of social behaviour. He stresses interaction between animals in different sorts of societies, covering such things as communication, aggression, grooming, the development of social behaviour and finishes the work by trying to answer the question "why the social?"

"Social behaviour of Animals" is a particularly useful book for students and naturalists who would like an elementary understanding of basic sociobiological concepts, and an explanation of some of the jargon, procedures and assumptions of biologists who investigate social behaviour. (P.S. The answer to my opening question? Ants and bees which have haploid drones as males.)

R. WALLIS

A Request

Charles Andersson (P.O. Box 350, Ringwood, Vic. 3134. A.H. 88 3881) and David King (Traum St., Port Arlington, Vic. 3223) are surveying past and present animal sightings and history of Swan Island near Queenscliff.

It is an island of tidal flats, salt marsh, Melaleuca and grassland which is presently restricted to use by golfers holding a pass from the Army. If you have seen any koalas, foxes, snakes, possums etc. there please contact either of the above. Help protect our heritage!

Predation On a Small Colony of Bats by an Australian Hobby, *Falco longipennis*

By Gregory V. Czechura*

Summary

Predation by a single Australian Hobby *(Falco longipennis)* on a small colony of bats was observed near Caboolture, southeastern Queensland. This falcon was observed to capture single bats over a period of three consecutive days. Each attack commenced with a high speed stoop, followed by a short, twisting flight ending with the capture of the bat close to the ground. On one occasion, a bat eluded capture after the initial attack. The falcon then attacked and captured another nearby bat in level pursuit.

Introduction

Among falcons occurring outside the Australasian zoogeographic region, eleven species have been recorded preying on bats (Table 1). Kestrels and hobbies figure prominently in this list.

The extent to which Australasian falcons prey on bats is not readily known. The only two records available of the Australian Hobby *Falco longipennis* taking bats (Fleay 1950; Key 1938) were clearly of a fortuituous nature. In both cases single bats, disturbed by a human observer at their daytime roosts, were taken by hobbies in the vicinity. Elsewhere in the Australasian region, Clunie (1972 a, b, 1976 a, b, 1980) records Fiji Peregrine Falcons *(Falco peregrinus)* preying on fruit bats of the genera *Pteropus* and *Notopteris*.

The following note reports on predation of bats by an Australian Hobby.

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Observations

All observations were made in grassy open agricultural land used for grazing dairy cattle about 0.5 km south of Caboolture, southeastern Queensland (27° 05′, 152° 57′). Tree cover was restricted to a few lone eucalypts and one small open stand of 17 trees.

This area also contained a number of scattered dead, hollow trees. One such tree observed for several weeks (June-July, 1979) was occupied by a colony of small, brown bats, possibly a species of *Tadarida* (S. Van Dyck pers. comm.) Several species of *Tadarida* are known to favour such sites for roosts (Hall and Richards 1979). The roost tree contained three separate exit holes (A,B,C in Fig. 1). The highest exit hole (A) was located about 5.5 m above ground level and was infrequently used. The remaining holes (B,C) were located 4.5 and 3.0 m approximately. On leaving these holes the bats dropped towards the ground (as described by Young 1980) before flying off to forage.

On the evening of 23 July 1979 the bats, while emerging, were attacked by a single Australian Hobby. The attack was commenced from high above the colony. After a brief twisting flight the falcon captured a single bat in its talons. Subsequently the hobby flew towards the township with its victim and was lost to sight.

On the following evening (24 July) the hobby was again seen to take a single bat under virtually identical circumstances. A diagrammatic representation of these attacks is shown in Fig. 1.

The final encounter took place on the evening of 25 July. The attack com-

TABLE 1

Literature records of falcon predation on bats: Eurasian, African and American species.

Species	Common Name	Reference
Falco alopex	Fox Kestrel	Brown 1970
F. ardosiaceus	Grey Kestrel	Brown and Amadon 1969
F. biarmicus	Lanner Falcon	Brown *in* Clunie 1972; Brown 1970; Brown and Amadon 1969
F. chicquera	Red-headed Falcon	Brown and Amadon 1969
F. columbarius	Merlin	Bent 1938; Johnson and Coble 1967
F. concolor	Sooty Falcon	Brown 1970
F. dicksoni	Dickson's Kestrel	Brown 1970; Colebrook-Robjent and Tanner 1977
F. eleonorae	Eleonora's Falcon	Brown 1970; Giglioli 1889-91; Walter 1979; Brown and Amadon 1969
F. peregrinus	Peregrine Falcon	Porter and White 1973; Sprunt 1950; Stager 1941, 1948
F. rufigularis	Bat Falcon	Allen 1939; Beebe 1950; Haverschmidt 1962; Murie 1935; Peters 1929
F. severus	Oriental Hobby	Brown and Amadon 1969
F. sparverius	American Kestrel	Black 1976; Heintzelman 1964; James and Hayse 1963; Orr 1954; Young and Blome 1975
F. subbuteo	European Hobby	Brown and Amadon 1969; Witherby *et al.* 1945
F. tinnunculus	Common Kestrel	Bent 1938; Gillette and Kimbrough 1970; Witherby *et al.* 1945

menced as previously. However, on this occasion the first bat attacked eluded capture by fluttering in tight circles around the roost tree and finally returning to a hollow. The falcon flew around the tree before pursuing a lone bat some distance from the tree. Briefly, after level pursuit over open ground, the bat was captured. The falcon circled, gaining altitude, and ate the bat which remained held in the talons. Patagia and several other parts of the body were discarded. Owing to poor light, it was not possible to locate any discarded material.

It is assumed that only a single Australian Hobby was involved in these observations as the bird 'appeared' at the roost at about the same time each afternoon, and subsequently flew off in the same direction towards the township. There was no evidence of the falcon perching in the immediate vicinity of the roost tree to await emergence of the bats.

Fig. 1. Diagrammatic representation of a successful Australian Hobby attack on a bat. See text for explanation of symbols used.

No subsequent bat-falcon encounters have been observed. The bats abandoned the roost sometime during August 1979 and this tree has since remained unoccupied.

Discussion

All attacks consisted of an initial high speed stoop followed by a series of high twists and turns in response to the bat's evasive manoeuvres (Fig. 1). Capture invariably occurred close to the ground, and a short distance away from the roost tree. In the only case where a bat eluded capture, the bat did so by remaining close to the tree and out-manoeuvring the raptor. I have observed rapid twisting escape flight around tree trunks is often successfully employed by small honeyeaters *(Melithriptus* spp., *Meliphaga* spp., *Myzomela* spp.) when pursued by Collared Sparrowhawks *Accipiter cirrocephalus.*

The initial stoop seemed to provide the falcon with a means of dispersing the bats around the roost tree and allowing it to single out a victim. Flocking or grouping behaviour on the other hand is known to decrease raptor hunting success (Page and Whitacre 1975; Opdam 1980). Judging from the events of July 25th, provided lone bats are present in the vicinity, a successful capture may result, although this initial strike is unsuccessful.

Several authors (Baker 1962; Black, Howard and Stjernstedt 1979; Gillette and Kimbrough 1970; Young 1980) have emphasised the vulnerability of bats to avian predators while emerging from their roosts while it is still light. The present observations support this view and further emphasise Baker's (1962) findings that the most efficient bat predators are those that are fast fliers which single out individual bats.

Of interest are the final stages of the chase leading to the capture of the bat. In all cases this involved the falcon closing with the bat and capturing it within 1-2 metres above ground level. At this point, the bat's evasive manoeuvres were poor due either to fatigue or lack of opportunity to manoeuvre. Walter (1979) found that a migrant bird under attack by Eleonora's Falcons *Falco eleonorae* would progressively lose altitude and sometimes touch water as a result. 'Apparently shocked by the whole experience, it would lose control and it was usually caught only seconds later' (Walter 1979, p. 92). The trauma experienced by a bat finding itself under attack and close to being grounded may contribute to a similar 'loss of control' or hesitation resulting in the bat's poor flight performance.

The above observations indicate that the Australian Hobby will hawk bats at dusk as do other hobby species. Interestingly, Morris (1977) has elsewhere observed the species hunting in predawn gloom. Nevertheless, it would seem that bats are relatively rare prey items, taken opportunistically. This is the only time Australian Hobbies have been seen preying on bats in the Caboolture area where their usual diet consists of small birds (e.g. honeyeaters, sparrows and starlings) and insects (e.g. grasshoppers, dragonflies and lepidopterans).

Acknowledgements

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A Slab of Devonian Fossils From Heathcote and a Little Palaeoecology

By J. V. Neil*

Introduction

Between 350 and 400 million years ago at the beginning of the Devonian period, the sea extended into the Heathcote district and most of central Victoria. In the shallow waters of the coastal margin, a variety of bottom-dwelling invertebrate animals had found an attractive environment in which to live. For several million years, generations of these animals lived and died, with little change occurring in the species represented in the populations of animals living in the shallow water zone. Of these animals, those which produced hard shells or outer coverings had the best chance of being preserved as fossils, though it is almost certain that soft-bodied invertebrates shared this environment with them (Laporte, 1968). Even the hard-shelled species faced little chance of preservation in the turbulent waters of the shelving coastal margin, and those which did resist eventual destruction may have been transported far from their original homes. But some were preserved, and now, at this unimaginable distance in time (by human standards), we can study them, and draw some interesting conclusions about how and where they lived. Such studies make up the science of palaeoecology — the study of ancient environments.

The Material

This simple study is based on one small slab of fine-grained, silty sandstone (Figure 1). On one surface, approximately 250 fossils are preserved in the form of internal or external moulds of the former hard parts of the animals. The slab, which is roughly quadrangular in shape, has an area of about 180 sq. cm., so that fossil moulds occur in the order of 1 or 2 per square centimetre. The fossils effectively cover the surface of the block, which has been split open to expose them, and they form a layer about 2 cm. in depth. Sedimentation rates in shallow waters suggest that this represents about 100 years (Laporte, 1968), which is a mere instant in geological time. The rest of the block, which is 3 to 4 cm. thick, appears to be much less fossiliferous. This is borne out by the much sparser occurrence of fossil moulds on the "under surface" of the block. The block has the typical brownish-orange colour of Palaeozoic sandstones and, although hard, can be fairly easily worked to expose the fossils. It is clear that only tentative inferences can be drawn from such a small sample from one location only, but extensive collecting in the district by the writer over many years substantiates the conclusions reached.

Figure 1: A slab of Devonian fossils

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The Location

The Heathcote and Redcastle areas (Figure 2) were geologically surveyed by the late Dr D. E. Thomas in the 1940's and his geologically coloured parish plans form the basis for any collecting in this area of richly fossiliferous Siluro-Devonian sediments. The faunas were described by Talent in 1965, though he restricted his work to the collections made by Dr Thomas. The slab which is the basis of this study was collected in the Parish of Redcastle, three or four kilometres to the east of Mt Camel, in an area of numerous fossil localities occurring in sandstones, siltstones and mudstones. They form part of the Mt Ida Formation (Talent, 1965). The area is characterised by notable changes in fossil faunas and rock types over comparatively short distances. Later articles will deal with other interesting occurrences from this area.

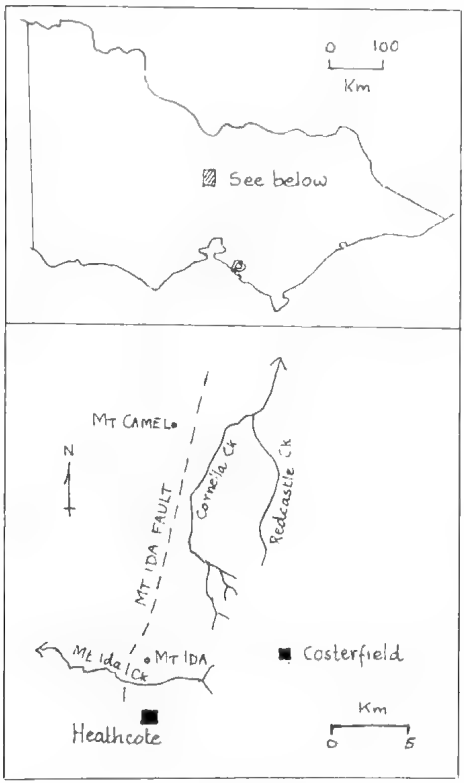


Figure 2: Locality plan of the Heathcote — Redcastle area

After The Animals Died

An important question which the palaeoecologist has to answer at this point is "Were the fossils preserved *in situ*, or have they been moved to a different location?" Did they undergo *post-mortem transportation?* Although it is not possible to be dogmatic on the basis of the evidence available, some suggestions can be made with reasonable assurance.

Some of the evidence points to a degree of transportation. Most of the fossils are of *epifaunal* animals (brachiopods, trilobites, corals, crinoids) — that is, animals which feed on or above the floor of the sea and are not firmly attached to it. After death, they are fairly easily moved. Even the crinoids, which are often quite firmly attached, are represented only by the columnals which form the stem of the animal. These are easily disarticulated and transported after death. The infaunal bivalve molluscs, which burrow into the sediments, are not numerous in the assemblage. Given sufficient turbulence, even they may be moved and transported after death.

Next one notes that all the brachiopod valves are separated — that is, not articulated. Ager (1967), one of the pioneers of palaeoecology, has stressed that brachiopods were normally buried with both valves articulated, because the muscles of the animal serve to open the shell, which otherwise remains naturally closed. Disarticulated valves indicate a high-energy environment with turbulence, though not necessarily any great measure of transport. Ager has also indicated that strophomenids lived on, and were adapted to, fine sediments (mudstones and shales) yet in this assemblage we find several large strophomenid valves in a sandstone

matrix. (See also Bretsky, 1968, for details of the strophomenid-trilobite association). This suggests post-mortem transport, though not necessarily on an extensive scale, since the valves were not broken, surface ornament was reasonably well-preserved and finer-grained sediments occur within 100 metres at a similar stratigraphic level. However, both Ager and Bretsky attribute the strophomenid-trilobite association to a deeper, sub-littoral shelf environment, so that their presence in the assemblage does not tie in well with the shallow-water hypothesis, unless post-mortem transport has occurred. The evidence is equivocal.

The assemblage discussed here does suggest some post-mortem transport as the shells formed a dense cluster, as if water movement had collected them in some local hollow on the sea floor. There is little regularity about the orientation of the moulds. If the plane of the strophomenid valves is taken as the plane of the sea floor (since these large, gently convex shells would normally lie flat), then the other shells are oriented rather randomly. This indicates clearly that the fossils were not preserved in the life position, and that they represent a collection gathered in one localised area.

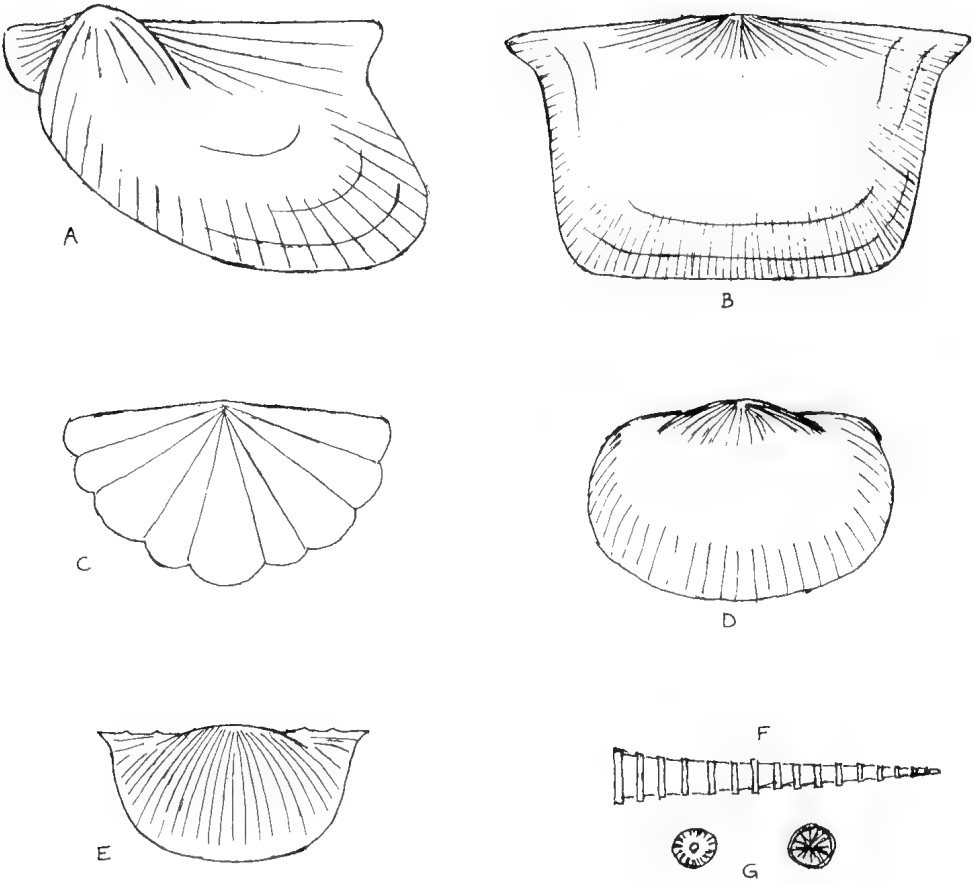
Although some examples of flute moulds have been found in the vicinity by the writer, these sedimentary structures, which usually indicate the action of turbidity currents in deeper water, do occur in shallow-water environments too, and so are not inconsistent with the conclusions which follow (Reineck & Singh, 1968).

The Fauna

The moulds or impressions on the block show that although a high density of fossils is preserved per unit area, there are not very many different kinds of invertebrates represented, nor many different genera of each family. (Identification to the species level is quite difficult for material preserved in this way.) No original shell material or hard parts remain — only the moulds in the sandstone. A group of different animals occurring in one place like this is called an *assemblage*. This assemblage, though numerically quite large, is not very diverse. The following genera are represented (See Figure 3):

Brachiopods	— the strophomenids *Stropheodonta* and *Maoristrophia* — the spiriferids *Howellella*, *Macropleura* and *Cyrtina* — the rhynchonellids *Stegerhyncus* and an indeterminate genus — the orthid *Isorthis* — the dalmanellacean *Schizophoria* — the chonetid *"Chonetes"* — the athyrid *Molongia*
Bivalve molluscs —	*Actinopteria* and an unidentified form
Tabulate corals —	*Aulopora* and *Thamnopora*
Trilobites —	the proetid *Coniproetus*
Echinoderms —	indeterminate crinoid columnals (stem-pieces)
Uncertain affinities —	*Tentaculites*
Vertebrates —	a spine (?) from an acanthodian placoderm ("spiny shark")

There are no bryozoans, gastropods, rugose corals or nautiloids in this assemblage, although they are common enough in localities nearby with similar rock-types. It is clear from this faunal list that brachiopods are the commonest



A — Actinopteria
B — Stropheodonta
C — Howellella
D — Schizophoria
E — "Chonetes"
F — Tentaculites
G — Crinoid columnals
J — Coniproetus (Head)
H — Stegerhyncus
(Figures not to scale)

phylum represented in this assemblage, and about 80-85% of the fossils are moulds of the valves of brachiopods. Of the genera of brachiopods, the rhynchonellids are very numerous, but the large strophomenids are the most noticeable, even though few in number. All the other phyla are represented by only a few moulds.

The Environment

It is possible to suggest the kind of environment in which these animals lived, whilst recognising that the place where they were collected together and buried under the sediment may have been quite a different one. The key to that problem is whether the fossils were transported, or preserved *in situ*. But first, what of the environment in which they lived? Brachiopods, like crinoids and corals, are suspension feeders. They filter food particles from the water which circulates through that part of their structure which has that function. Naturally, a degree of turbulence is necessary if the food particles are to remain in suspension, so that the presence of numerous suspension feeders suggests turbulent, rather than calm, water. But turbulence affects bottom-dwelling invertebrates only if the water is relatively shallow. In deeper water, the ocean floor remains largely undisturbed by water movements of the more vigorous kind. Consequently, the brachiopod — dominated assemblage suggests the turbulent or high-energy waters of the coastal shelf. Finally, the sand and silt-sized particles which form the matrix of this slab indicate deposition in the shallower near-shore waters, whilst the finer detritus, which does not settle out until the deeper regions of the shelf are reached, forms shales and mudstones.

The commonness of rhynchonellids in the assemblage is significant in this regard because of their distinctive ridged shells with a zig-zag opening between the valves. Rudwick 1964 has shown that this zig-zag opening is an evolutionary adjustment to enable the animal to circulate water through the valves to obtain food, whilst excluding large, sand-grain-sized particles from entering. All of the foregoing factors point to a shallow-water, near-shore environment as the location in which these animals lived.

Conclusions

The general weight of evidence favours a shallow-water, near-shore environment for the accumulation of this assemblage of fossils, though not all the evidence supports this conclusion. The high incidence of suspension-feeding animals, the disarticulation of the brachiopod shells, the random orientation of the valves, the commonness of rhynchonellids within the fauna and the dearth or absence of silty and muddy components in the matrix — all of these suggest turbulent, relatively shallow water. It is likely that some post-mortem transport of the shells and other hard parts took place. The occurrence of strophomenids and trilobites in the assemblage suggests that they have been transported from an environment of finer-grained sediments, though not necessarily over a great distance. The other elements of the assemblage may also have been transported, though the sandstone matrix in which they are found proves nothing. The high concentration of fossils and their random orientation is a final piece of evidence which can be explained by transportation and dumping, perhaps in a localised depression in the sea floor. This would not necessarily entail any change in the environment unless the distance involved was considerable.

This simple study does show that the picture of the environment in which these animals lived so many millions of years ago can be built up from fairly limited evidence, if one uses both induction and deduction, and if one has access to the ideas of palaeoecologists who have studied similar problems. The con-

clusions reached from this one slab of fossiliferous rock are in agreement with the views of workers in this field of Victorian geology in recent years (Vandenberg, Garratt and Spencer-Jones, 1976) — namely that the Heathcote area in the Early Devonian was a shelf area near the shores of an embayment extending east from the Cambrian Mt. William-Colbinabbin axis.

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Naturalist Review

"Light and Plant Life"

BY J. M. AND F. R. WHATLEY
Edward Arnold, 1980. London, pp:92.
Recommended retail price $10.20.

This little volume is No. 124 in the continuing "Studies in Biology" sponsored by the Institute of Biology, London. It provides a general introduction to the many ways in which plants respond to light. In ninety two pages a great breadth of subject is covered, beginning with a discussion of the photochemical reactions of photosynthesis and concluding with the influence of light as an ecological factor. There are fascinating but short sections on light influences on rhythmic phenomena in plants and on bee and other pollinator responses to flower colour.

This book will be particularly useful for undergraduates and for teachers long frustrated by the absence of an accessable reference on plant responses to light. Teachers and amateur scientists will be particularly interested in the chapter "Suggestions for Practical Work". One difficulty with this book is the absence of an index. As the book is introductory it is unlikely that the reader will have the expertise to substitute the table of contents for a detailed index, even if the book is only small.

E. McClellan.

Australian Natural History Medallion Fund

Amount on hand May 1981	$1603.50
The Bairnsdale Field Naturalists Club.	10.00
Total July 1981	$1613.50

A List and Further Notes on the Butterflies From Glenbrook, New South Wales.

By T. J. Hawkeswood*

Abstract

Observations and collections of butterflies in the Glenbrook area of the lower Blue Mountains, New South Wales, during the three month period, December 1976 to February 1977 are provided. A total of 28 species were recorded.

Introduction

The township of Glenbrook is situated about 70 km (43 miles) by road, west of Sydney (33°45′S, 150°38′E), at an altitude of 163 m (535 feet) above sea level. Much of the natural bushland in the immediate vicinity of Glenbrook has made way for residential development but there are still areas where fruitful entomological collecting may be undertaken.

Glenbrook receives an average annual rainfall of about 80 cm (32 inches) and temperatures range broadly from 1°C to 40°C. Good summer rains in excess of 200 mm (8 inches) fell during the three months in which observations and collections were undertaken.

The present vegetation of the Glenbrook area is one of dry sclerophyll forest composed of at least five species of *Eucalyptus* (i.e. *E. gummifera* (Gaertn.) Hochr., *E. crebra* F. Muell., *E. eximia* Schau., *E. piperita* Sm. and *E. notabilis* Maiden, all Myrtaceae) and two species of *Angophora* (i.e. *A. bakeri* C. Hall and *A. floribunda* (Sm.) Sweet (Myrtaceae). Species of *Acacia* (e.g. *A. ulicifolia* (Salisb.) Court and *A. linifolia* (Vent.) Willd., Mimosaceae), *Hakea sericea* Schrad., *Banksia spinulosa* Sm. and *Persoonia levis* (Cav.) Domin (Proteaceae) and *Bossiaea heterophylla* Vent., *Oxylobium ilicifolium* (Andr.) Domin and *Phyllota phylicoides* (Sieb. ex DC.) Benth. (Fabaceae), are dominant plants which compose the shrub layers of the forest surrounding the township of Glenbrook.

During the summer of 1976-1977, *Angophora* and some *Eucalyptus* species flowered profusely as did *Bursaria spinosa* (Cav.) Druce (Pittosporaceae) and *Leptospermum* species (Myrtaceae). Introduced weed species, (e.g. *Bidens pilosa* L. (Asteraceae), a plant common along roadsides and in cleared areas), flowered abundantly during this period and many adult butterflies were taken visiting the flowers of these plants.

Apart from the native plants mentioned above and the weed species mentioned in Table 1 below, there were few other plants flowering in the bush which could have afforded food for adult butterflies. However, in residential gardens, various flowering plants were probably visited for nectar by many butterflies.

Materials and Methods

Observations and collections were made more or less continuously throughout the summer in the bush surrounding Glenbrook, with somewhat more intensive collections being made in January and February, 1977. (Casual observations were also made during the previous summer of 1975-1976).

Specimens collected were captured by net, examined, then released or retained alive for later identification.

The nomenclature used for the butterflies follows that of Common and Waterhouse (1972) and that for the plant species mentioned follows that of Beadle *et al* (1972).

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Table 1. A [illegible] South [illegible], Dec. [illegible] Feb. [illegible], with [illegible] of adult food plants.

SPECIES	OCCURRENCE	ADULT FOOD PLANTS
Nymphalidae		
Danaus plexippus plexippus (Linnaeus)	Rare, Jan	[illegible]
Danaus affinis affinis (Fabricius)	Rare, Feb	
Hypocysta metirius Butler	Few, Feb	
Hypocysta pseudirius Butler	Common, Feb	
Hypocysta adiante adiante (Hübner)	Common, Dec-Jan	
Geitoneura acantha acantha (Donovan)	Very common, Dec-Feb	
Geitoneura klugii klugii (Guérin-Méneville)	Common, Feb	
Heteronympha merope merope (Fabricius)	Very common, Dec-Feb	
Tisiphone abeona abeona (Donovan)	Common, Jan-Feb	
Ypthima arctous arctous (Fabricius)	Common, Feb	
Polyura pyrrhus sempronius (Fabricius)	Uncommon, Jan-Feb	
Vanessa kershawi (McCoy)	Common, Jan-Feb	[illegible]
Vanessa itea (Fabricius)	Common, Feb	
Precis villida calybe (Godart)	Common, [illegible] Feb	[illegible]
Lycaenidae		
Jalmenus evagoras evagoras (Donovan)	Common, Feb	[illegible]
Zizina otis labradus (Godart)	Very common, Dec-Feb	[illegible], 13
[illegible]	Few, Feb	
[illegible]	Common, Jan-Feb	
[illegible]	Common, Jan & Feb	[illegible]
[illegible]		
Trapezites symmomus symmomus Hübner	Few, Feb	[illegible]
Pasma tasmanica (Miskin)	Rare, Feb	
Toxidia parvula (Plotz)	Common, Dec-Feb	
[illegible] (Lower)	Common, Dec-Feb	
Papilionidae		
Graphium [illegible] (C. & R. Felder)	Uncommon, Dec-Feb	
Papilio anactus W.S. Macleay	Uncommon, Jan-Feb	
Papilio aegeus aegeus (Donovan)	Uncommon, Dec-Feb	
Pieridae		
Eurema smilax (Donovan)	Rare, Feb	
Pieris rapae rapae (Linnaeus)	Common, Dec-Feb	

[illegible]

OCCURRENCE: Rare = ≤ [illegible]
Few = [illegible]
[illegible] = [illegible]
Common = [illegible]
Very Common = > [illegible]

ADULT FOOD PLANTS N = native W = introduced weed species
\- = no data available or not observed

Asteraceae
1. *Cassinia uncata* A. Cunn ex DC. (N)
2. *Taraxacum officinale* Weber (W)
3. *Coreopsis lanceolata* L. (W)
4. *Erigeron floribundus* (H.B.K.) Sch.Bip. (W)
5. [illegible] (W)
6. *Tagetes minuta* L. (W)

Malvaceae
7. *Pavonia hastata* Cav. (N)

Caprifoliaceae
8. *Lonicera japonicum* Thunb. (W)

Thymeleaceae
9. *Pimelea linifolia* Sm. (N)

Pittosporaceae
10. *Bursaria spinosa* (Cav.) Druce (N)

Myrtaceae
11. *Baeckea linifolia* Rudge (N)

Verbenaceae
12. *Verbena rigida* Spreng (W)

Fabaceae
13. *Trifolium* sp. (W)

Discussion

Although the Glenbrook area supports a small butterfly fauna (at least during summer), most of the species are common (Table 1). Populations of these species appear to be well established in the area despite widespread destruction of native vegetation. The introduced weed species appear to afford nectar to adults of some butterfly species when relatively few native plants are in flower. *Pimelea linifolia* Sm. (Thymeleaceae), a plant which flowers for most of the year, is visited for nectar by many adult butterflies (Table 1).

Rare butterflies of the Glenbrook area include *Danaus plexippus plexippus* (Linnaeus), *D. affinis affinis* (Fabricius) (both Nymphalidae), *Pasma tasmanica* (Miskin) (Hesperiidae) and *Eurema*

The first of these, *Danaus plexippus*, is the well-known Wanderer or Monarch Butterfly, which occurs throughout eastern Australia. The larval food plants in Australia are the introduced cotton bushes *(Asclepias fruticosa, A. curassavica), Asclepias rotundifolia, A. semilunata, Calotropis gigantea,* and the moth-plant *Araujia hortorum* (all members of the Asclepiadaceae) (Common and Waterhouse, 1972, pp. 221-222). As none of these plants grow in the Glenbrook area, it is unlikely that the butterfly breeds there. It is most probable that *D. p. plexippus* is a migrant to the Glenbrook area.

Danaus affinis (Black and White Tiger) occurs in coastal north-west Australia (Kimberleys, W.A.) to Darwin and Arnhem Land (Northern Territory) and from Cape York Peninsula (and the

islands of Torres Strait) along the east Australian coast to Port Macquarie (N.S.W.) (Common and Waterhouse, 1972, p. 223). These authors also state that this butterfly is a common coastal species north of the Richmond River (N.S.W.) but only a few specimens have been taken as far south as Sydney. Thus my record of *D. affinis* from Glenbrook is noteworthy. Common and Waterhouse (1972, p. 224) also state that the larvae of *D. affinis* feed on *Cynanchum carnosum* (Asclepiadaceae), a trailing plant which grows on the margins of salt creeks and swamps amongst reeds. As this food plant does not occur at Glenbrook and the lower Blue Mountains (Beadle *et al*, 1972, pp. 418-419), it is doubtful whether this butterfly breeds in the area unless an alternative food plant (at present unknown) is utilized.

Pasma tasmanica (Tasmanica Skipper) occurs on the tablelands of southern Queensland to eastern Victoria, occurs all over Tasmania and adults are on the wing from October to March (Common and Waterhouse, 1972, p. 97). One adult was collected in a *Eucalyptus crebra* F. Muell. forest in the Blue Mountains National Park, 2 km south of Glenbrook township on 5 Feb. 1977. Little is known about the biology of this butterfly. Whether or not it breeds in the lower Blue Mountains remains to be determined.

Eurema smilax (Small Grass Yellow) occurs throughout mainland Australia but is rarer in southern areas (Common and Waterhouse, 1972, p. 260). The species is known to breed on species of *Cassia* (e.g. *Cassia fistula*, *C. coronilloides* and *C. nemophila*, Caesalpiniaceae) (Common and Waterhouse, 1972, p. 200). No native *Cassia* species occur in the lower Blue Mountains at Glenbrook, but some ornamental cassias growing in residential gardens and garden escapes (e.g. *C. colluteoides* Coll. and *C. floribunda* Cav.) (Beadle *et al*, 1972, pp. 276-277) may be utilized by this butterfly.

Butterfly research in Australia has, in the past, been more concerned with identification of larval food plants rather than with adult food plants. Studies are only beginning to show that some butterflies may be important in the pollination of certain native plants which possess tubular flowers (e.g. *Pimelea* (Thymeleaceae), Keighery (1975)), while others may play a lesser role in the pollination of other plants which are predominantly pollinated by beetles, flies and/or wasps and bees (Hawkeswood, 1979). Although no pollen loads were examined, Keighery (1975, p. 49) lists various butterflies as pollination vectors of a number of *Pimelea* species. These plants have tubular flowers with nectar at the base of the corolla-tube. The anthers are exserted on long filaments while the narrow style and stigma are also prominently exserted. These floral characters (in association with others) characterize the syndrome of psychophily (i.e. butterfly pollinated blossoms (Faegri and Van der Pijl, 1976)). Plants which are readily visited by butterflies at Glenbrook and possess most or all of the above mentioned floral features include *Lonicera japonica* Thunb. (Caprifoliaceae), *Pimelea linifolia* Sm. (Thymeleaceae), *Verbena rigida* Spreng. (Verbenaceae), *Bidens pilosa* L., *Tagetes minuta* L., *Taraxacum officinale* Weber and *Coreopsis lanceolata* L. (Asteraceae). A majority of these species are introduced weeds (Table 1).

Large flowered plants, such as *Lonicera japonica*, are probably better suited to pollination by larger butterflies. The medium-sized *Vanessa kershawi* (McCoy), the only butterfly found on *L. japonica* (Table 1), appears to be a generalist in its feeding habits, and as such, is not restricted to *L. japonica* (Table 1). Keighery (1975) lists *V. kershawi* as a pollination vector of *Pimelea*

sulfurea, *P. ferruginea* and *P. rosea* in Western Australia. Conversely, small flowered plants such as *Verbena rigida* (Verbenaceae), *Bidens pilosa* and *Tagetes minuta* (Asteraceae) and *Bursaria spinosa* (Cav.) Druce (Pittosporaceae), are probably better suited to pollination by smaller butterflies such as the Skippers (Hesperiidae) and the Blues (Lycaenidae). However, large butterflies such as *Danaus plexippus plexippus* (Linnaeus) and *Polyura pyrrhus sempronius* (Fabricius) (Nymphalidae) have been seen feeding from blossoms of small-flowered plants (Table 1).

The data presented in this paper is not complete by any means, and additional field observations should reveal further species (especially during the winter and spring months) and add many new adult food plants.

In addition to this paper, supplementary notes on certain butterflies of the Glenbrook area may be found in Hawkeswood (1980).

Acknowledgements

I would like to thank Mr J. D. O'Dea, Department of Physiology, University of New England, Armidale, N.S.W., for reading through an earlier draft of this paper written in April 1978. I also thank my mother, Mrs D. E. Hawkeswood, for providing facilities in order that this research could be undertaken in Glenbrook.

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New FNCV Subscription Rates in January 1982

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Earth Stars: The Family Geasteraceae Fischer

By G. A. Crichton*

Earthstars have mystified people throughout the ages, and apparently still do. One lady, startled by the sudden appearance of a crop of them in her back yard, hastily shovelled them out of sight, no doubt many of them lustily blowing off clouds of spores at this indignity.

Many amateur naturalists and, from the state of the literature, not only amateurs, have been confused by this interesting group of the fungi. The world revision of the family Geasteraceae* Fischer by Ponce de Leon, Fieldiane: Botany 31(14):303-349 (Feb., 1968) divides the family into three genera-Geasteroides, Myriostoma and Geastrum. The first is not known for this region, Myriostoma has recently appeared in the Sydney Botanic Gardens and must be regarded as a recent migrant; so it is with Geastrum we are here concerned.

Local members of this genus were dealt with by G. H. Cunningham in his Gasteromycetes of Australia and New Zealand, 1944; but many of these have now been relegated to synonyms in the present revision.

Listed below is the present nomenclatural position of those species in the approximate order in which they occur in Cunningham's key. Accepted names in bold face. Synonyms below.

G. pectinatum Pers. 1801
G. plicatum (Berk.) Cunn. 1942
G. bryantii (Berk.) Fisch. 1933
G. elliptice Cunn. 1942

G. lloydianum (Rick) P. Ponce
G. hariotii (Lloyd) Fisch. 1933
G. campestre (Morg.) Stanek, 1958
G. campestre (Morg.) Kambley and Lee 1936
G. clelandii (Lloyd) Cunn. 1942
G. ambiguum Mont. 1839
G. smithii (Lloyd) Cunn. 1942
G. drummondii (Berk.) Cunn. 1942
G. minimum Schw. 1822
G. minus (Pers.) Fisch. 1933
G. arenarium (Lloyd) Cunn. 1942
G. Coronatum Pers. 1801
G. limbatum (Fries) Cunn. 1942
G. Javanicum (Lev.) P. Ponce 1846
G. velutinum (Morg.) Fisch. 1933
G. schweinitzii (Berk. and Curt.) Zeller 1948
G. mirabile (Mont.) Fisch. 1933
G. subiculosum (Cooke and Masse) Cunn. 1942
G. saccatum (Fr.) Fisch. 1933
G. indicum (Klotz.) Rauschert, 1959
G. triplex (Jungh.) Fischer, 1933
G. australe (Berk.) Cunn. 1942
G. quadrifidum Pers. 1801
G. fenestriatum (Pers.) Fisch. 1933
G. fimbriatum (Fr.) A. H. Smith, 1951
G. fimbriatum (Fr.) Fisch. 1933
G. floriforme (Vitt.) Cunn. 1942
G. simulans (Lloyd) Cunn. 1942
Astraeus hygrometricus (Persoon, 1801) Morg. 1889, *G. hygrometricum* Persoon, 1801:
generally placed in the family Astraeaceae.

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"Field Guide to the Non-Marine Molluscs of South Eastern Australia"

BY BRIAN J. SMITH AND RONALD C. KERSHAW.

X + 285 pp, numerous text figures and maps. Australian University Press, Canberra, 21 December, 1979. Recommended Australian retail price $9.50.

This is a most welcome addition to the molluscan literature of Australia. It breaks new ground in that for the first time, Australian collectors of land and fresh-water shells have at their fingertips a reference describing and illustrating all the known species of a rather large segment of this island continent. The mere fact that such a reference as the Field Guide is available will undoubtedly lead many into the non-marine field.

As this name implies, the Field Guide is not a glamorous book to grace the coffee table. It is utilitarian in appearance and presentation, and is essentially a book to use in the field, in the laboratory, and in the home. The authors' aim has been to produce more than a check-list and less than a revisionary monograph. They have achieved a good middle stance where available data have been gathered together, for better or for worse, synthesized and freshly illustrated. By so doing, they have probably left themselves open to criticism of specialists, but at the same time the lesser experts and collectors will be untiringly grateful that there is a readily available reference.

South eastern Australia as covered by the Field Guide includes the densest populated portion of the continent, plus everything from temperate rain forest to arid, almost desert land. The 212 species described or mentioned indicate the richness of this varied habitat. Of these, 207 species are figured, and 115 maps indicate the known distributions. Extensive use of keys, in many places accompanied by line drawings to show the features being separated in the key, is made throughout the book. These should prove most useful, particularly to anyone attempting to identify some of the smaller punctid and charopid shells.

The Field Guide has been beautifully illustrated by Rhyllis Plant. Her clear figures show the salient features so important in identification of the shell. The figures are all of uniform size, regardless of the size of the species concerned. This tends to show up in place as big featureless shells and small sculptured shells. Without doubt, the main purpose of the Field Guide is to offer a ready source of identification at species level. And for every species in the text, the author, date and reference is given. Some would expect the same data to be presented for the numerous genera used throughout the book. In referring to the systematic list at the back of the book, one finds curious lists of synonyms below the valid species, each with only the intial letter of the original genus and no further explanation.

All in all, a fascinating, well illustrated book, full of a wealth of information and certain to stimulate further observation and research on the non-marine molluses. It achieves its aim, has something for amateur and professional, and is not unreasonably priced. It is highly recommended to all.

Robert Burn

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Rare and Endangered Victorian Plants
2. Brachycome muelleroides

By J. Stuwe*

The present paper is the second of a series outlining results of recent research into the distribution and conservation status of plants thought to be rare or endangered within Victoria. The aim of the series is outlined by Stuwe (1980). The species dealt with here is *Brachycome muelleroides*, a small, annual daisy (Fig. 3).

Range and abundance

In Victoria, the species is known only from one stand in Barmah Forest, minor grid L53, and several stands on Ulupna Island, north of Strathmerton, minor grid L54 (Fig. 1). Estimated numbers of plants were 500-1000 at Barmah and over 1000 from Ulupna Island. However, 1980 was a good season for this species and fewer plants could be expected during more usual years (W. Stebbing, pers. comm.). It was recorded from Picola, minor grid M7, in 1930 by J. H. Willis but has not been found there since. Crown Land on Ulupna Island, including the area carrying this species was proclaimed a Public Purposes (Preservation of Flora and Fauna) Reserve in 1969. The flora of the reserve, which includes another rare *Brachycome* species, *B. readeri*, has been outlined by Muir (1972). The Barmah Forest population is not reserved.

B. muelleroides also occurs in New South Wales in the Walbundrie district and at Wagga (McBarron, 1952; Willis 1972). The Wagga record, however, is probably based on a collection lodged at The National Herbarium, Melbourne, dated 1889.

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The species was classed as 'Vulnerable 3V' on an Australia-wide basis by Hartley and Leigh (1979). Although it occurs within a biological reserve, it has been classed as 'Endangered' within Victoria in the present work because of its limited distribution, relatively small numbers of plants (especially when life-span is considered) and threats to the fragile environment it occupies (see below).

As this species is a small annual, less than 15 cm high and often only 5-7.5 cm, and is not likely to be recorded outside its flowering period, it may have been overlooked in other riverain forests of northern Victoria such as Gunbower Forest as well as in other areas of Barmah Forest. We would like to know of any records of this species other than from Ulupna Island Reserve.

Habitat

In Victoria, the species is restricted to shallow depressions with heavy, cracking topsoil, where herbaceous plant cover and plant litter (including eucalypt leaf litter) are sparse (Figure 2.) Surrounding areas are dominated by *Eucalyptus camaldulensis* or *E. microcarpa* although eucalypts are sparse to absent within this species' habitat. The depressions would be seasonally inundated and the area forms part of the Murray River floodplain.

Threats and recommended conservation measures

Cattle grazing, the use of recreational vehicles and (potentially) timber extraction, combined with associated soil disturbances and the ingress of weeds are the major threats to this species. The

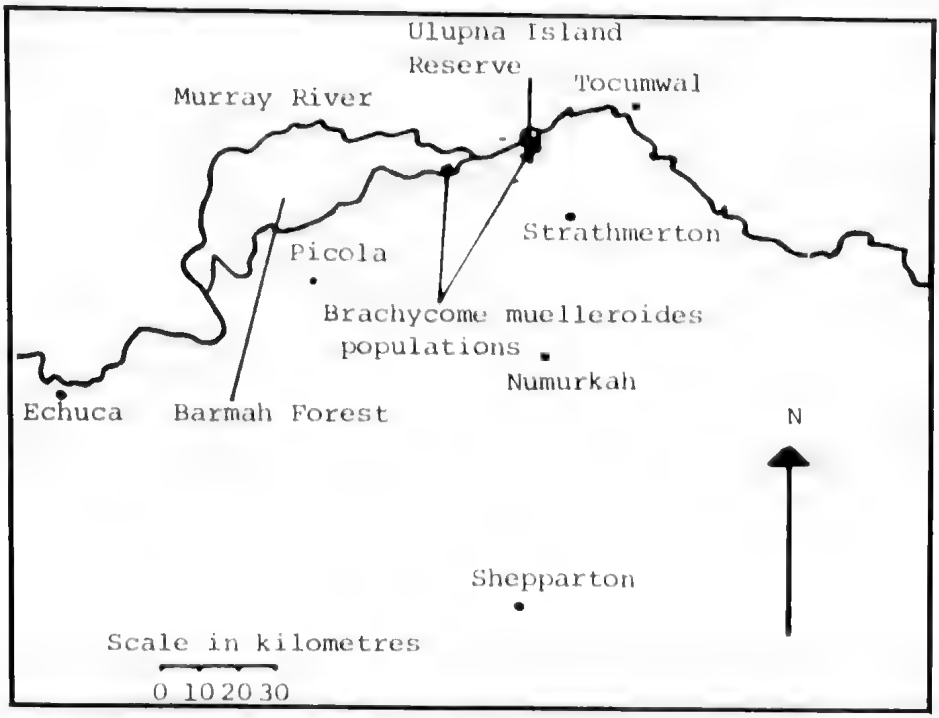

Figure 1. The distribution of *Brachycome muelleroides* in Victoria

Fig. 2. *Brachycome muelleroides* and associated species.

regulation of water flow in the Murray River, especially the decrease in flood frequency (Dexter, 1967) may have affected this species' range, although relevant data are lacking. Possible further controls resulting from the completion of the Dartmouth Dam may threaten this species in the future.

Low-lying, seasonally inundated areas are usually extremely sensitive to disturbances caused by domestic stock or vehicles during the wetter months. Although many such habitats at Barmah and Ulupna Island have been disturbed and invaded by weeds, a number have largely escaped damage. This is somewhat surprising when the long history of grazing is considered but may be explained by the seasonal nature of such activities. At Barmah, and possibly in the past at Ulupna Is., domestic stock are removed during the wetter months of the year (E. Chesterfield, pers. comm.). Similarly, recreational activities at both areas are largely restricted to the summer season when the heavy topsoil of this species' habitat is hard and not as readily susceptible to disturbance.

Fig. 3. *Brachycome muelleroides* habitat (foreground) on Ulupna Island.

Domestic stock, vehicles and timber extraction should be excluded from areas carrying this species. The Barmah population, including an adequate buffer, should be formally reserved. As riverain forests of northern Victoria are not adequately reserved, a large reserve at Barmah encompassing various plant communities, including this population and other *B. muelleroides* habitat, is desirable.

The reservation of the section of Ulupna Island carrying this species has lessened but not totally removed the current threats. Sporadic, illegal cattle grazing still occurs, areas of past disturbance carry well-established populations of serious weeds, adjoining farmland represents a source of invasion of introduced species and the area is popular with campers and day trippers, especially during summer. Regular monitoring is necessary here to attempt to quickly detect and/or control processes which threaten these populations. It is hoped that the infestations of weeds will be largely checked once processes causing soil disturbances are removed. Blanket spraying or forms of weed control involving soil disturbances may adversely effect *B. muelleroides* and other native species and should be avoided if possible.

The establishment of Ulupna Island Reserve offers an example of how interest and a good deal of effort by local residents has been invaluable in the protection of rare plant species and a range of habitats which are otherwise unreserved in that part of the state. Another benefit of such interest is in ready monitoring and a general understanding of local problems.

Recommendations sent to:

Forests Commission, Victoria; Department of Crown Lands and Survey; Ulupna Island Reserve Committee of Management.

Acknowledgements

I wish to thank Mr W. Stebbing, Secretary of the Ulupna Island Reserve Committee of Management for valuable discussion and assistance in locating and protecting populations of this species. The work is funded in part by a grant from the National Estate Programme of the Australian Department of Home Affairs.

Why Not Look Beyond the Flowers?

BY C. H. HENSHAW

Upsurge in Natives

Fifty years ago, interest in indigenous Australian flora was at a very low ebb, but today it wins acclaim and attention from a wide spectrum of the population. Although a large number of people share this common interest, their involvement is manifested in many different approaches.

The home owner seeks a decorative setting and believes he will have least trouble looking after a property planted with well-tried natives; a similar category of people realize they will receive a bonus if they concentrate on bird-attracting plants; the keen gardener is willing to go to some trouble to have a wide range of flowering natives throughout the year; the specialist delights in the challenge to grow the rarer and more difficult genera or species; the naturalist, interested in the world about him, wants to have a slice of it close at hand for study, or perhaps just peace and relaxation; the botanist studies microscopic parts and concentrates on taxonomic distinctions of selected Australian plants; the bushwalker likes merely to be there and only rarely does his curiosity prompt him to enquire about specific names; the nurseryman is keen to develop new and better garden species and he appreciates the help the gifted amateurs can offer; and there is the dedicated conservationist who desperately strives to protect the natural environment from the many forces inimical to it.

Who Are The Conservationists?

This writer finds himself in several camps with perhaps greatest kinship to the last category, and gets slightly peeved when people advocate leaving conservation to the conservationists. Who are the conservationists but ourselves? It is often overlooked that the conservation movement is basically a confederation of many organizations like ours, and being chronically short of cash and manpower, it needs as much help as it can get from all constituent groups.

Natural History Problems

In November, 1980 the fifth Conservation Council of Victoria Awareness Tour visited the Little Desert and few, if any, of those attending joined from a sense of duty. Most had been on previous tours which had provided enjoyable visits to unusual, off-beat places with the opportunity to discuss conservation matters with local people and hopefully to gain an insight into their problems. This time they met with farmers centred on Goroke who were seeking some way to prevent correllas in plague proportions from eating their crops. A truly formidable problem! We had no magic words.

At Lake Charlegrark, nearby, there were many questions for Research Officer Geoff Gourlay who is in charge of a pilot project to propagate Murray Perch, a native fish in many ways more suitable to the environment than imported trout. The rare *Acacia enterocarpa* (Jumping Jack Wattle with seed pods like the firecracker!) is alive and well at Diapur thanks to Land Officer Geoff Hollingsworth who had planted the former school ground with seedling acacias grown at the Forest Commission Wail Nursery.

Earlier, en route, the party had been shown by Councillor Chris Hedges of Beaufort, well-timbered roadside verges and the location signs he persuaded his colleagues should be erected to protect them — from official bulldozers, mainly. Nearing Ararat, we stopped for lunch at Dobie Highway Park situated about a tree-girt stream that is one of the upper reaches of the Hopkins River. A very tatty Lands Department Reserve when seen a couple of years earlier, the Park is now a fine example of what can be achieved by a clean-up and the installation of the few necessary structures in a simple naturalistic manner. There are more to come on other highways.

Later in the tour we met people involved in creating a garden/plantation of Australian Natives in the grounds of the Nhill State School — but what is even better, enlisting the real co-operation and interest of the children.

Botanists Delight in Desert

During most stops the four or five amateur botanists managed to make a quick survey of the local flora and vied with each other in identifying unfamiliar specimens. In the Little Desert, many plants new to us were seen.

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Murrumbeena, 3163.

One or two lingering purplish blooms indicated the strikingly beautiful *Melaleuca wilsonii* had just finished flowering but *Melaleuca uncinata* which at first distant sighting could be mistaken for an acacia in full bloom, was very widespread. Another believed to be *Melaleuca neglecta* was flowering profusely in places, but it is not nearly so spectacular. At the Desert Lodge were wide expanses carpeted with creamy flowered *Kunzea pomifera* (Muntries); here and elsewhere were huge clumps of *Callistemon macropunctatus*, some 10 m. long by 5 m. through and about 3-4 m. high, covered with scarlet bottle-brushes and chock full of birds.

The Gompholobiums looked very like the species *huegelii* some of us had seen a few weeks earlier in the Brisbane Ranges, but they may have been *G. ecostatum;* and the attractive *Olearia ciliata* seen in these Ranges, helped me to identify it in the desert. The Billardiera we frequently saw was not the familiar *B. scandens* but *B. cymosa*, as Willis says, a shrubby twiner — a most attractive plant with bluish or mauve flowers in corymb-like clusters and glossy, bright green leaves. It would make a desirable garden plant, but is rarely seen in cultivation. The flowers are somewhat like those of a Crowea but smaller, more profuse and of variable color in a single cluster.

Idle Speculation on Origin

Water loving plants such as *Marsilea drummondii* (Nardoo), *Triglochin* spp., *Utricularia dichotoma* (Fairies Aprons) and an unidentified grassy reed were seen in a swampy area surrounding a man-made waterhole. No stream or even dried-up watercourses were seen here or elsewhere in the sandy desert although there is evidence that water collects in shallow depressions for a short while before sinking into the earth. The question arises as to whether the water-loving plants happened to be in residence when the waterhole was made, survivors perhaps in a damp micro-environment, from some earlier wetter epoch; or were the ancestors of these plants the lucky ones out of the millions of seeds and spores continually wind-borne over the earth's surface — the lucky ones that lodged in the man-made wet environment where they could germinate and flourish — an outpost in an alien land? Or was there a more mundane answer — the plants had been brought in deliberately by man, or accidentally, as seeds, perhaps on equipment used to scoop out the dam?

Desert Problems

It will be appreciated that the term "desert" is misleading — the average rainfall ranges from 16 inches upwards to 20 as you go westward to the South Australian border — far in excess of the maximum figure of ten inches generally applied to deserts. The name was given mainly because much of it is sandy, sterile and deficient in minerals necessary for crops. This however did not prevent various blocks being selected in the early days including several along the Nhill-Goroke Road, the northern and southern fringes and one or two large blocks in the centre of the western sector.

Many people probably think the Little Desert problem was settled when fledgling conservationists first realised their potential power and they united in protest to stop McDonald's land grab back in 1969 — an exercise which resulted in this gentleman losing his Parliamentary seat.

However the National Park which eventuated covers only the eastern half of the desert and although the parts not in private hands in the west are vested in the Lands Department, this does not give the security of a National Park. Envious eyes have been cast on this section from several sources. A city company has plans for developing a large central tract. The southern boundary (and perhaps the northern one) is an irregular eastwest line with many incursions into the desert where the original selectors thought optimistically that the soil was good enough for cropping. Now, in order to reduce the cost of fence maintenance, local land owners are advocating that the boundary with desert crown land should be a straight line through the most northerly of the privately owned sections.

"Crater" At Risk

Perhaps a good idea in theory, but this would eliminate some desirable floristic areas; also the unique "crater", a fascinating kidney-shaped hollow several hundred metres in extent, surrounded by a jagged sandstone rim. Crater is a misnomer, the depression being formed neither by volcanic action nor a meteor but is probably due to the collapse of a cave roof by removal in solution of underlying material — a bit like a giant crab hole so-

called. (cf. Gregory). This area was submerged by the extensive Murray Gulf of the Miocene era (Sherbon Hills) and underwater currents may also have contributed to the unusual formation.

It was on the rim of the "crater" we saw the frail tiny bipinnate leaves of *Acacia mitchellii* with flowers. Another wattle of restricted distribution, *A. rupicola* was at Mt. Arapiles where also was said to be an unusual form of *A. pycnantha* which we didn't stop to examine closely. The lovely magenta blooms of *Pelargonium rodneyanum* were seen only along the rocky outcrop bisecting the desert in a NNW/SSW direction, surfacing west of Nhill as the low Lawloit Range. Also in the vicinity of the "crater" were a relation of the Dusty Miller, *Spyridium vexilliferum* with the distinctive velvety white foral bracts and another dwarf species possibly *P. subochreatum*. Further from the "crater" there were at least two hakeas in flower — *H. rostrata* distinguished by their characteristic beaked fruit and another with smaller fruit. By the time we consulted our reference books we couldn't decide between *H. rugosa* and *H. muellerana*.

Orchids were scarce but the lovely dark blue *Lobelia gibbosa* seen near our lunch spot had a comparable beauty. There were many other interesting plants seen but long lists without adequate comment can become tedious.

The Irresistible Appeal Of Flowers

People had said in no uncertain terms that we would be mad to expect a floral display in the Little Desert around this time of the year (Late November). It is realised that the commencement of flowering seasons can vary up to a month or more depending on the seasonal climate, so perhaps the hot dry spell contributed to the splendid range of flowers we saw. However, this preoccupation with flowers does raise the question, "Why not look beyond the flowers?"

On this and indeed most other excursions into the wild, a plant has to be blooming before it is given any attention by anyone except the most dedicated botanist! I suppose it is normal and natural for people to be most affected by the beauty and color of the flower. When they are absent, a plant is sometimes difficult to identify and I am delighted when I can do so.

Possibly we are moving into the realms of one-upmanship but I suggest that amateur botanizing trips in the bush could gain a new dimension if we gave more attention to the plants without flowers and also those with minute, insignificant floral displays. After all, most of us have mastered the commoner Victorian flowering plants. Why not accept the challenge of identifying those seen out of season? Reference to Willis's Handbook or Jean Galbraith's Field Guide can often help you, even if only by a process of elimination.

An Esoteric Pleasure?

There is the added interest of finding plants rare in a particular area, a new variety or form, or perhaps one not yet recorded. It is not impossible. Only recently the "Victorian Naturalist" Vol. 98, No. 2, published the first record of *Acacia notabilis* for Victoria. You may even have a species named after you!

Knowledge of our resources is so woefully inadequate that the possibility of finding new, unnamed flora is always present; such a plant may prove to have a medical or chemical potential. What a pity if it were to be wiped out before we discovered it?

Field Naturalists Club of Victoria

Reports of recent Club activities

General Meeting
Monday 10 August

Dr C. C. Lu spoke of two scientific explorations: one in icy seas of the Indian Ocean far south from Madagascar, the other in tropical seas south of the Philippines. Dr Lu's chief interest is the Cephalopoda (many-armed molluscs) and he showed slides of various species of octopus and a pearly nautilus (each with eight arms), squids and cuttlefish (ten arms or, more correctly, eight arms plus two long tentacle arms that are retractable). A question about the

beautiful nautilus shell sometimes found on beaches brought the response that it is from the paper nautilus Argonaut, and it is produced only by the female to serve as an egg-case.

Exhibits. A pale green stick insect 20cm long (8") was feeding on Cootamundra blossom. The pupa (2.5cm) of a Wanderer Butterfly was a dark colour indicating that it was approaching emergence, and large colour photos showed the eggs, caterpillar, light green young pupa, and the adult butterfly.

Several small seaweeds of various colours were displayed in a flat jar.

Under miscroscope were some sea spiders — all legs and no body for the intestines etc are housed in the legs; attached to seaweed by a fine thread were some hydroids that looked like white discs with an arc of fine long hairs; a clump of red bryozoa failed to open out the tentacles from each dented ball-like individual, but still looked very fascinating; and there were colonies of living diatoms shown at low and at higher magnifications.

Amy Fuller Paintings. The Club has a hundred or more paintings of Australian wildflowers by Amy Fuller but few people see them. Some of them, mounted on large cellophane-covered cards, were exhibited this evening with the suggestion that they should be loosely bound into volumes, or perhaps made into concertina folders and some displayed at each meeting.

Natural History Medallion. Another casting cannot be taken from the original die of the natural history medallion and many members are not happy about that design. Consequently our Council has been investigating other methods and the possibility of a new design by a recognised artist.

General Meeting
Monday 14 September

Members stood in silence in respect for Mrs Swaby who died last week.

Honorary membership was conferred on Mr Roy Dodds — 40 years in FNCV. In making the presentation, Mr Ros Garnet said that Roy was an enthusiastic member of the Geology Group and leader of many geology excursions.

The evenings programme was arranged by the Botany Group. the Group's chairman, Mrs Hilary Weatherhead, announced that various aspects of heathlands would be presented by different Group members.

Tom Sault stated that heathlands usually occur on windblown sand dunes or sometimes on compacted clay. He spoke of some of the mammals one would expect to find in heathlands.

Introducing the plants, Hilary Weatherhead said that heathlands occur on infertile soils that cannot support substantial trees, any trees being short. Winds trim heathland plants to a fairly uniform height, often about 60 cm (2 ft), and many plants have tough, small or hairy leaves in defence against the drying conditions. Nevertheless, there is a great variety of species and spring is the time to see many of them in flower.

Margaret Potter showed slides of heathland plants from several areas. They included many heaths (family Epacridaceae), other woody plants, and some guinea flowers.

Peter Carwardine spoke of some of the insects that live on heathland plants and gave some fascinating items about "skipper" butterflies (family Hesperidae). They are inconspicious yellows and browns with a wing span not more than 2.5 cm (1") so are not often noticed. Peter described some of the characteristics these butterflies share with moths, their jerky "skipper" flight, and the leaf tubes made by the larvae where they hide during the day.

Mary Doery said that birds depend on both plants and insects, and divided heathland birds into four groups — small brown birds which she called Little Brown Jobs, honeyeaters, brightly coloured birds, and birds of the sky. She

(Continued from inside front cover)

Tuesday, 8 December. Members night.

First Wednesday — Geology Group.

Wednesday, 7 October. Granites of Wilsons Promontory. Speaker: Gary Wallis.

Wednesday, 2 December. Members night.

Third Wednesday — Microscopy Group.

Wednesday, 21 October. Marine life under the microscope. Speaker: H. Bishop.

Wednesday, 18 November. Photography through the microscope (movied and 35mm). Speaker: P. Genery.

At the Conference Room, the Museum, at 8.00 p.m.

Good parking — enter from Latrobe St.

First Monday — Marine biology and Entomology Group.

Monday, 2 November. No meeting — Cup Day.

Monday, 7 December. ABC meeting.

GROUP EXCURSIONS

All FNCV members are invited to attend Group excursions.

Botany Group — last Saturday.

Saturday, 25 October. Langwarrin and Cribb Point.

Mammal Survey Group.

Saturday, 10 — Sunday, 11 October. Enterprise Range, Eildon.

Saturday, 31 October — Tuesday, 3 November. Cup weekend. Big Desert.

Saturday, 28 — Sunday, 29 November. Melton.

Christmas camp. Boxing Day — New Year's day. East Gippsland.

Geology Group.

Sunday, 11 October. Cape Liptrap.

(Continued from page 222)

showed slides of each group, beginning the LBJs with a male blue wren!

Then came slides by Ilma Dunn of more heathland plants which included several orchids and bulbous plants.

Exhibits. There was an entire bench of heathland flowers, and another benchful of books with illustrations of skipper butterflies.

An X-ray photo of wood showed the many tunnels made by the shipworm teredo. Three small Australian land snails, family Succincidae, each about 1 cm tall (less than ½") crawled up the wall of their container.

In a bowl of sea water were some galeolaria and sea weeds. Two galeolaria worms had been removed from their tubes, placed in a smaller dish within the sea water and put under 8X microscope. The worms were 5-8 mm long in a J shape, brownish colour with whitish "feathers" at the top — the feeding part. In the same small dish a sea spider was swimming around, about 2 cm across its spread of slender brown-banded legs.

Under a 20X microscope were some hydroids *Stauridium productum* — slender transparent stalks perched on seaweed with finer branches at the free end, each branch ending in a tiny ball. These were found at Black Rock and is possibly the first record for Port Phillip Bay.

Field Naturalists Club of Victoria

Established 1880

OBJECTS: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
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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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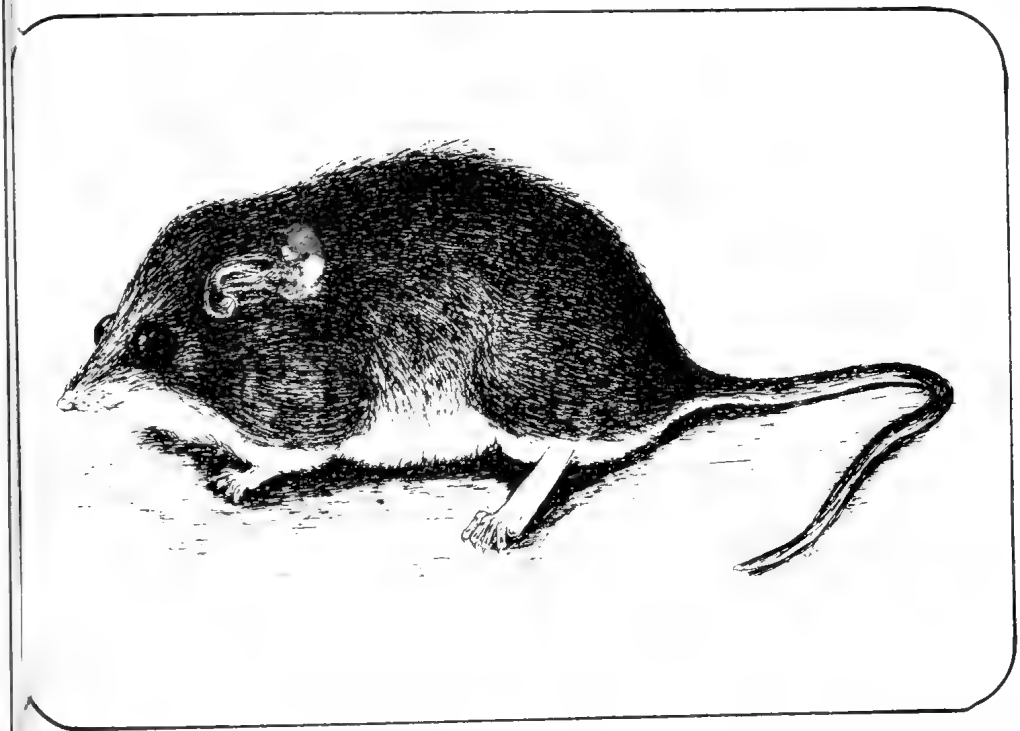

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GENERAL MEETINGS

At the National Herbarium, the Domain. South Yarra.

Monday, 14 December, 8.00 p.m.
Meeting to be hosted by the Hawthorn Juniors.

Monday, 11 January, 8.00 p.m.
Members night.

Monday, 8 February, 8.00 p.m.
Speaker: Miss Wendy Clark. Spiders.

New Members — November/December General Meetings.

Ordinary
Mrs F. Grassick, 45 Devon St., Eaglemont.
Ray Martin, 106 Murrumbeena Rd., Murrumbeena.
Peter Mason, 30 Heath Ave, Mt Evelyn.
Robert Price, 180 Serpell's Rd., Templestowe.
Lesley Skinner, 6 Kyora Pde., North Balwyn.
Miss M. Thomas, 82 Stokes St., Port Melbourne.

Joint
Lauren Halliday, c/o 4 Grange Ave., Canterbury.

FNCV EXCURSIONS

Saturday, 16 — Friday, 22 January. Portland. This will be hosted by the Portland F.N.C. The cost will be $220 for coach and DBB motel accomodation; this should be paid by the December General Meeting. The coach will leave from Flinders St outside the Gas and Fuel at 8.00 a.m. Bring a picnic lunch.

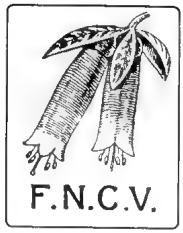
Sunday, 7 February. Point Leo, Merricks Beach bush and beach excursion. The coach will leave Batman Ave at 9.30 a.m. Fare $8.50. Bring a picnic lunch. Leaders: Elizabeth Turner and Mary Davy.

Saturday, 6 — Monday, 8 March. Combined weekend at Morwell. This year the annual V.F.N.C.A. weekend gathering will be hosted by the Latrobe Valley F.N.C. Cost for coach and B & B accomodation will be $80.00. Deposit of $20.00 should be paid to the Excursion Secretary when booking. Camp sites are available at the Aquatic Centre and also on shores of Hazelwood Pondage. Members wishing to camp should make their own bookings.

Preliminary notices:

Would members interested in an excursion to Western Australia in September/October 1982 please advise the Excursion Secretary as soon as possible. Tentative plan: Friday, 24 September Perth to Jurien Bay; 25th Pinnacles National Park; 26th Jurien Bay to Merriden; 27th Merriden to Kalgoorlie; 28th Kalgoorlie area; 29th tour of old mining towns; 30th Kalgoorlie to Esperance; 1st Esperence; 2nd Experence to Albany for 4 nights with day trips including Stirling Ranges; 6th Albany to Manjimup; 7th Manjimup to Augusta; 8th Augusta to Busselton; 9th Busselton to Perth. The night prior to the tour and the night we return to Perth would be included but not transport between Perth and Melbourne. Costs would depend on the numbers going but at present would be about $900 based on 30 party members. Members may wish to extend their time in Perth and group fares to Perth may be arranged.

(Continued on page 267)



The Victorian Naturalist

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Cover illustration: *Sminthopsis leucopus*, Sketch by Terry Coates

A Mass Stranding of Sperm Whales, *Physeter macrocephalus* Linnaeus, 1758 at Macquarie Harbour, Tasmania

BY D. E. ROUNSEVELL*, R. J. PEARSE* AND P. DAVIS*

Abstract

On 15 January 1981 a herd of 26 sperm whales, *Physeter macrocephalus*, composed of mature females, subadults of both sexes and dependent young, became stranded in the entrance to Macquarie Harbour (42°13′S., 145°14′E.) on the west coast of Tasmania. The herd was first observed off the coast the day before the mass stranding occurred and a continuous account of significant events which took place during the period of the stranding is given.

Nine of the stranded whales escaped, four with assistance from people helping them and five without. One of the escaped whales later restranded and died on the beach 12 km north of the harbour but as many as 8 of them may have survived. It is the only record in Australia of stranded sperm whales returning to the sea alive and moreover while still stranded whales were alive.

Introduction

Sperm whales are one of the most commonly stranded species of whale in Tasmania. Eighteen earlier strandings are reported by Guiler (1978) and one large individual was stranded at Settlement Beach (40°, 02′S, 147°, 53′E) on Flinders Island on 29 August 1978 (R. J. Pearse).

Most recorded strandings of this species were on sandy beaches on the northern and western coasts of the Tasmanian mainland or on islands in Bass Strait. The 20 strandings to date have involved 15 lone individuals, one pair of females and four large herds. The three previous mass strandings involved 38 whales (all males) at Perkins Is., 1911 (Scott, 1942), 58 whales at Cape Grim, 1970 (Guiler, 1978) and 32 whales at Stanley, 1971 (The Mercury, 29/3/71). The latter were nursery herds, composed of adult females, immatures and dependent calves.

This paper gives an account of a mass stranding of a nursery herd at Macquarie Harbour on 15th January 1981 and records some events and biological information resulting from that stranding. The stranding has been widely reported in the press, on television and elsewhere (Anonymous, 1981).

The locality of the stranding is shown in the diagram (Map 1). To the north is the 20 km arc of Ocean Beach, a uniformly graded shallow sandy beach, and to the south is Cape Sorell, a rocky headland projecting into deeper water. The entrance to the harbour is shallow and treacherous and except in Kelly Channel the bottom is a system of mobile sandbars not shown on Map 1.

Chronological account of stranding

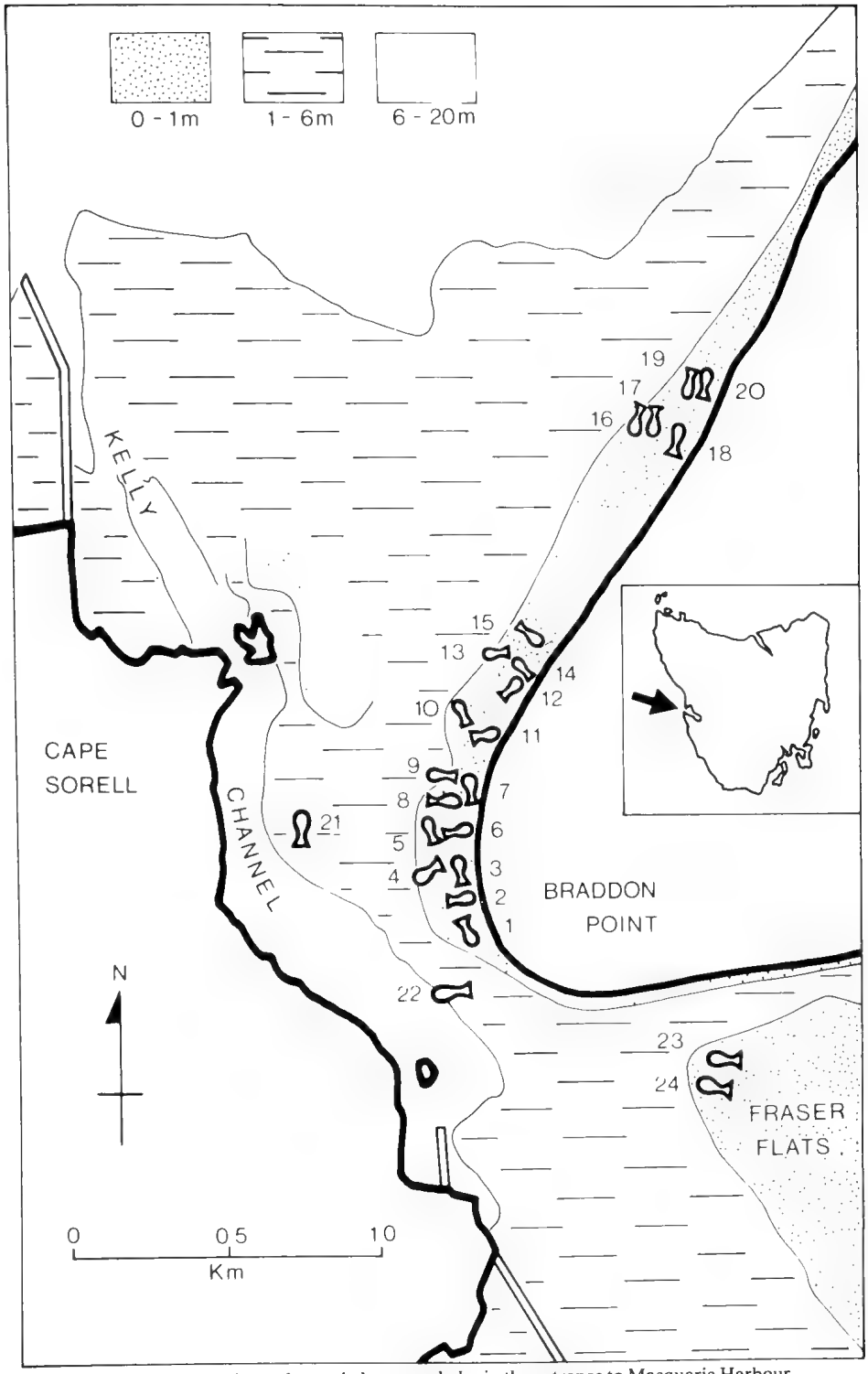
Wednesday 14 January (Maximum temperature 35°C)

7 p.m. An abalone diver from Strahan located a herd of approximately 20 sperm whales travelling slowly southwards 25 km NW of the entrance to Macquarie Harbour and followed them for a short time.

Thursday 15 January (Maximum temperature 25°C, minimum 19°C)

5.20 a.m. A fisherman asleep on a boat in Kelly Channel (Map 1) was woken up by loud pinging noises and saw whales swimming freely in channel. Another fisherman counted 17. During the next 2 hours more whales entered the

*Tas. Nat. Parks and Wildlife Service, Sandy Bay Tas. 7005



Map. 1. The locations of stranded sperm whales in the entrance to Macquarie Harbour.

harbour and the ebb-tide commenced. The sky was overcast, the sea was calm and the wind was less than 5 knots.

8 a.m. Twelve whales aground on Fraser Flats, a sandbar covered by water to a depth of less than a metre. Abalone divers in a 470 hp. twin-hulled "Shark-Cat" attempted to herd the free swimming whales back to sea without success. A small whale on the beach opposite Fraser Flats was towed into deep water but swam back to the beach when released. Attempts to tow two large whales resulted in the boat being towed backwards!

12 noon. Strahan Police and N.P.W.S. Ranger Davis alerted. Davis identified whales and counted 26 animals. The day was cool, the sky completely overcast, the sea calm, and the whales appeared healthy and undamaged.

2 p.m. Low tide. There was virtually no wind all day.

8.30 p.m. Twenty four whales stranded inside harbour. Two whales seen earlier on the seaward breakwater had gone, presumed escaped to sea.

Friday 16 January (Temperature maximum 28°C, minimum 14°C)

8 a.m. High Tide.

6 a.m. Twenty four whales still stranded but at least 11 had moved overnight from Fraser Flats to the tip of Braddon Point. Only two whales aground on Fraser Flats.

9. 30 a.m.- 12 noon. Authors recorded the locations of whales (Map 1) and the sex and measurements of accessible animals (Table 1). The day was warm and cloudless with light breezes and the sea was calm. Five large whales (Nos. 16-20) aground on sandbars or in shallow channels of water were dead and nearly all the whales were sunburnt. Campers and tourists helped live whales by splashing sea water over them all day.

2 p.m. Low tide.

7 p.m.-10 p.m. N.P.W.S. Ranger Davis attempted unsuccessfully to tow whales with 6 m jet boat by attaching rope to tail but they panicked and either broke the rope or towed the boat backwards. As the tide rose a number of near-buoyant whales were pushed towards deep channels with the boat but they repeatedly grounded themselves. Finally two whales were pushed into the deepest channel and headed for the sea. One escaped to sea but the other appeared too weak to swim against the tide. However, it escaped overnight. During the night, 3 other whales escaped without assistance.

Saturday 17 January (Temperature maximum 30°C, minimum 15°C)

2 a.m. High tide.

10 a.m. An overcast day and a calm sea. Nineteen whales remained; 10-14 of them dead. Davis, Project Jonah personnel, campers and a local contractor using his backhoe dug holes and channels during the day so that whales were cooled and would be better able to move at high tide. Davis unsuccessfully attempted to tow a small whale. A veterinarian with the Project Jonah team killed a dying whale with the drug Lethabarb. (Project Jonah is the name of a private organisation concerned with the welfare of whales).

12 noon. One escaped whale restranded and later died on Ocean Beach 12 km north of Macquarie Harbour. One large female in the northern group which had died on Thursday night burst open and shed a 4 m male foetus.

4 p.m. An escaped whale re-entered the harbour and Davis using his boat turned the whale so that it could escape later on high tide.

8 p.m. About 40 persons, campers, Tasmanian Wilderness Society members and Project Jonah personnel attempted to push 4 whales into deeper water on the rising tide but without success.

10 p.m. Davis in boat checked the whale which had re-entered the harbour at 4 p.m. and found it swimming freely seawards. He went to another whale which had freed itself, but was swimming in wrong direction. It was turned

and ran aground but continued attempts to swim. The whale rolled itself 3 times to reach deeper water. An hour later with much guiding both whales were out of the harbour. The smallest live whale (no. 3) was then rolled by a group of people into water deep enough for it to swim.

Sunday 18 January (Temperature maximum 27°C, minimum 17°C)

10 a.m. Only 4 whales were still alive. No attempt was made to shift them until high tide in the evening. The whales were monitored all day and repairs made to the boat.

8 p.m.-10 p.m. Unsuccessful attempts were made to shift the live whales. One dying whale was shot.

Monday 19 January.

10 a.m. Three whales were still alive. During the day one whale died, another was killed by the veterinarian and the third was towed into the channel by a fishing boat but it died just after it was released.

9 p.m. All remaining stranded whales were now dead. An aerial survey of Ocean Beach at 11 p.m. by the Project Jonah team did not locate any further restranded whales.

Discussion

There were no mature males (over 15 m in length) among the stranded whales nor were any observed at sea. Five of the nine stranded whales which eventually excaped, left voluntarily while some of the still-stranded whales were alive. Another 4 whales also left with some assistance. Of these nine whales one later restranded and died on the beach some 12 km north of Macquarie Harbour. This is the first Australian record of sperm whales leaving a mass stranding while other stranded whales were still alive.

The stranding took place during heavy overcast and unusually calm weather for the region. During the stranding itself on 15 January and until 18 January only light breezes prevailed and the sea was calm, lacking any swell or choppy conditions. The timing of the tide was irregular and unpredictable, and its range was limited to approximately 60 cm.

It is thought that the herd swam southwards perhaps following the contour of the coast which is a long 20 km arc of sandy beach until it reached the vicinity of Cape Sorell, a high rocky headland forming the southern side of the entrance to Macquarie Harbour. For an unknown reason the herd apparently attempted to pass east of this headland and thus entered the shallow water offshore of the harbour mouth on a flood tide. Perhaps a misinterpretation of acoustic cues by the animals when in the vicinity of the harbour entrance led up to the stranding. It is most probable that the herd entered the stranding area by passing north of Entrance Island. At this time the five large whales (Nos. 16-20) probably became stranded close to the beach in series of narrow channels north of Braddon Point. The position of a further 2 whales temporarily stranded on the breakwater also suggested that the herd did not pass south of Entrance Island. The remaining 19 whales reached Braddon Point where some of them may also have become stranded in shallow water. At least 13 of the whales passed around Braddon Point and 12 of them ran aground on Fraser Flats, and another on the beach opposite. No further movements of whales were recorded within the harbour entrance until the second day of the stranding. Then it was discovered that all but 2 of the 13 whales on or near Fraser Flats had moved back to locations on the western side of Braddon Point and the two whales on the breakwater had gone. By then the first stranded group were lying completely out of the water on exposed sandbars parallel to the beach. They were dead and their skin was beginning to peel. All the remaining whales were half submerged or more than half submerged, the smallest ones lying closer to the

Table 1: Measurements and other details taken on 16/1/81 from 20 sperm whales stranded at Braddon Point on 15/11/81. Body length was measured from tail notch to anterior of head; head length, anterior of head to base of flipper and flipper length, base to tip of flippers.

	Length (m)			Comments
Sex	Body	Head	Flipper	
	6.0 (est.)			No. 3, alive
Female	6.8	1.8	0.62	No. 7, alive
Male	7.7	2.4	0.74	No. 11, alive, wry jaw (bent left)
Male	8.5	2.4	0.79	No. 8, alive (?)
Male	9.0	2.7	1.00	No. 6, alive
Female	9.4	2.8	0.98	No. 10, alive (?)
—	10.5	3.0	1.00	No. 16, dead
Female	10.8	3.3	1.00	No. 17, dead
Female	10.9	2.8	0.95	No. 12, alive
Female	11.0	3.0	0.93	No. 18, dead, gravid
—	11.0	3.1	1.05	No. 5, dead, broad white mid-dorsal stripes.
Female	12.0	3.4	1.12	No. 19, dead
Female	12.0	3.4	0.95	No. 9, alive

Whales No. 1, 2, 4, and 13-15 all apparently alive; No. 20 was dead. See Map 1 for locations of numbered whales.

beach in shallower water. Most of the live whales lay on their right sides with blow holes uppermost. The larger whales bore numerous groups of circular scars (approx. 3 cm in diameter) presumed to have been made by the suckers on the tentacles of giant squid (Family Architeuthidae).

That some of these whales survived for up to 125 hours, and others escaped, is probably due to their partial submergence in the water and the narrow range of the tide throughout this period. The limited wave action and onlookers constantly splashing them down would have cooled them and also helped to prolong their survival. The live whales were vocal and although slow-moving, appeared to be healthy and undamaged from stranding after 24 hours. Nevertheless those that later escaped with assistance were lethargic, and appeared to be too weak to swim against the incoming tide.

The youngest whales in the herd; were Nos. 3, 7, 11 and 8 (Table 1) and with the possible exception of No. 8 were dependant calves lacking irrupted teeth. The smallest (No. 3) lay close to No. 4 which may have been its mother and was one of the largest whales in the herd. The wry jaw of the youngest male (No. 11) was not caused by the stranding but was either a genetic deformity or the result of a very early injury. At least one female (No. 18) was gravid. She burst open 2.5 days after dying on an exposed sandbar and shed a near term (4.0 m long) male foetus.

The number and size of animals involved in a mass stranding of sperm whale, or other species of large whale, make their rescue a large-scale undertaking. Such strandings are rare events and cannot be predicted. The possibility of rescue depends upon the accessibility of the site and many other prevailing circumstances. Generally, people are un-

prepared to cope with such strandings when rescue is possible, as the stranding at Macquarie Harbour demonstrated. Nevertheless it is possible to prepare contingency plans to enable prompt action where rescue attempts are feasible or where mercy killing is necessary. No such plan operated during the present stranding but available equipment and manpower was applied with great initiative. Unfortunately no tissues (blood, etc.) were obtained for study. The present stranding demonstrated that some live whales may be returned to the sea with human assistance. Whether all or any of the whales which escaped, aided or unaided, have survived the effects of stranding and the destruction of their herd is not known.

Acknowledgements

The authors wish to thank Mr R. M. Warneke for commenting on an earlier draft of this paper.

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East Gippsland Flora

"The Distribution and Conservation of Native Vascular Plants in the East Gippsland area, Victoria" (124 pp.)

BY A. C. BEAUGLEHOLE

is available from
The Portland Field Naturalists Club
P.O. Box 470, Portland, Victoria 3305
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The earlier publications 'The Distribution and Conservation of Native Vascular Plants in the Victorian Mallee' similarly' . . . in the Corangamite-Otway and Alpine area Victoria' are available from the same address for $6. Victorian Vascular Plant Checklists' (13 Study Area and 24 Grid Distribution) is also available at $6.

Mistletoe in Introduced Trees

I have noticed a number of trees bearing various loads of mistletoe, mostly Drooping Mistletoe, in widely separated suburbs of Melbourne. The trees affected have been Cherry-plum, English Elm, Liquidamber, Oak (English & Pin) and Silver Birch. This seems a disparate series. The greatest concentration I have seen is among the Pin Oaks in Mont Albert Rd., East of Balwyn Rd.

From the conservation view, it could well be that we are seeing the start of a threat to our street trees. As a naturalist, I have mused on the apparent selectivity and on whether the seeds have been spread by native or introduced birds — or both. It seems to open up fields of enquiry by the local Councils and perhaps by members of our Club.

K. J. Marshall

The Herpetofauna of Yellingbo State Faunal Reserve

By Ian Smales*

Introduction

The Yellingbo State Faunal Reserve is situated 48 km due east of Melbourne, in the eastern foothills of the Dandenong Range. The Reserve, one of the State Wildlife Reserve system, is administered by the Fisheries & Wildlife Division, primarily for the conservation of the endangered Helmeted Honeyeater (*Lichenostomus melanops cassidix*). As a result of the Reserve being the major colony site of the Helmeted Honeyeater, and the consequent interest of the Fisheries & Wildlife Division and the Bird Observers' Club, its avifaunal composition is well known. The Reserve supports a varied mammal fauna. This is known to have included the Yellow-bellied Glider (*Petaurus australis*) in the past and indications are that they may persist here, however no comprehensive or recent study of the mammal fauna has been carried out.

The present survey was undertaken with the following objectives:-

- To record the species of reptiles and frogs present within the Reserve.
- To determine, if possible, the microhabitat requirements of the species present and consequently the vegetation associations, or structures necessary to maintain such microhabitats and their dependant herpetofauna.

Since this investigation was begun Hutchinson (1979) has published a survey of the reptiles of Kinglake National Park. It is felt that a comparison of his survey with the present one, in so far as the reptiles are concerned, may be meaningful and so a deliberate attempt has been made to present a format similar to his.

*Fisheries and Wildlife Division, P.O. Box 6, Yellingbo, Vic., 3139.

Methods

Between December 1978 and December 1980 a record was kept of all the reptile and amphibian specimens observed on or adjacent to the Reserve. The initial specimen/s of each species recorded was collected for identification and these specimens have been lodged with the National Museum of Victoria. All specimens taken were collected by hand and no trapping methods were used, except for some unsuccessful attempts to collect *Chelodina longicollis* using drum nets.

The entire survey was carried out incidental to maintenance and management work on the Yellingbo S.F.R. and when such work was being done along the Reserve boundary, the opportunity to check the herpetofauna on land immediately adjacent was taken.

Taxonomy

The amphibian taxonomy follows Brook (1979), while the taxonomy for reptiles is that of Cogger (1979), with two exceptions. Following Coventry's (1976) diagnosis of *Hemiergis* the skink *Saiphos maccoyi* Lucas & Frost is excluded from *Hemiergis* and retained in the genus *Anotis*. However this is simply for the sake of consistency with other recent workers and until its taxonomy is settled, since the name *Anotis* is preoccupied. The skink *Egernia luctuosa* which was formerly thought to consist of two disjunct populations, one in the South West of Western Australia, and the other in Victoria was split by Storr (1978), who erected the name *E. coventryi* for the Victorian species.

The Reserve

The Reserve is basically in the shape of three narrow strips, consisting of land on either side of portions of three

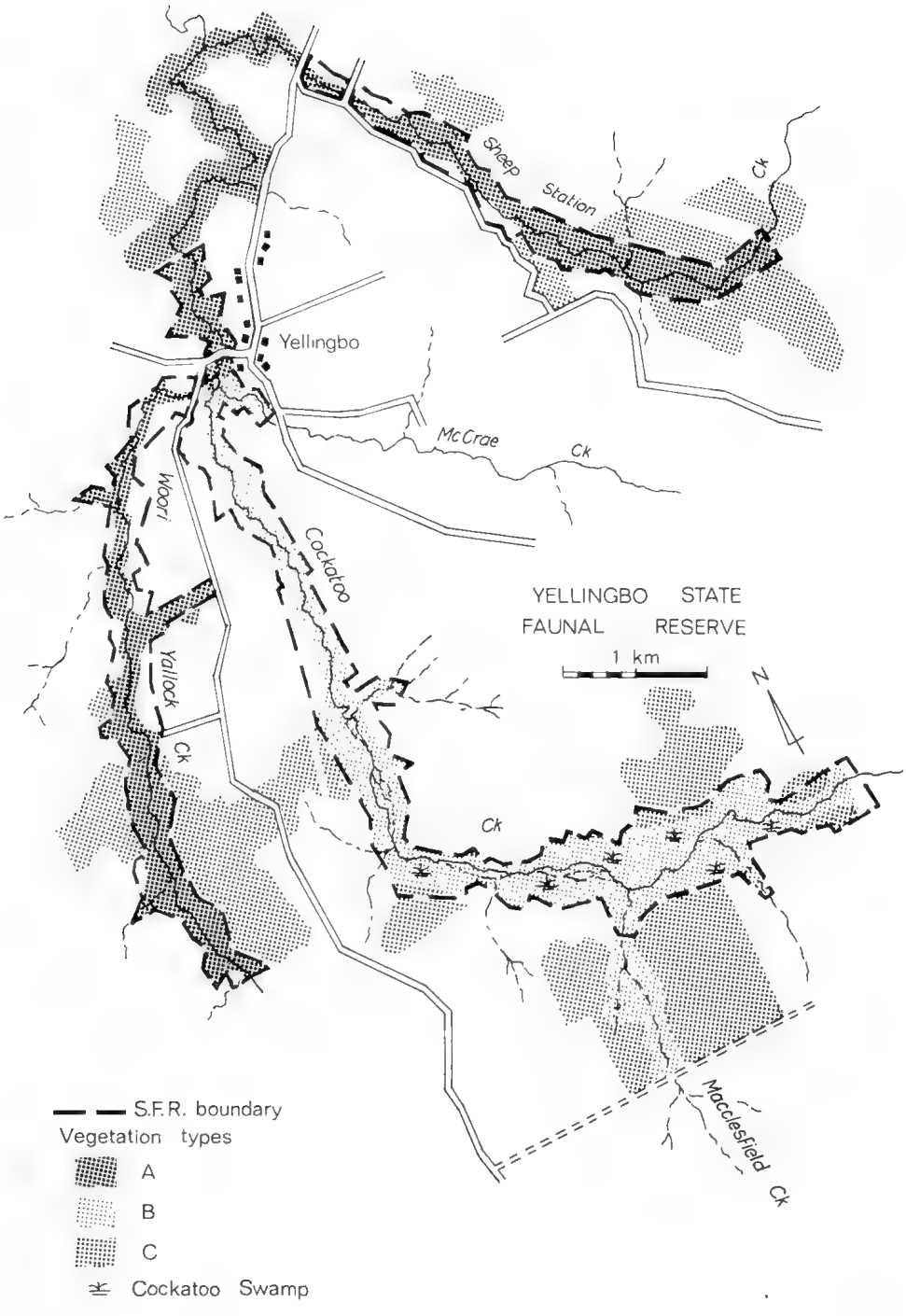

Fig. 1. Yellingbo State Faunal Reserve.

creeks; the Woori Yallock, Cockatoo and Sheepstation. (fig. 1). At the time of the initial creation of the State Faunal Reserve in 1967, the then Fisheries & Wildlife Department assumed management of the standard crown land stream frontage reserve. Since that time the State & Federal governments have carried out a program of land purchase so as to increase the Reserve to its present size of approximately 340 ha.

Throughout their lengths within the Reserve, the Woori Yallock and Cockatoo Creeks each fall from approximately 120m to 90m above sea level. The Sheepstation Creek falls from about 140m to 90m.

The Reserve lies between the 1,200mm and the 1,400mm rainfall isohyet (L.C.C. 1973).

Soil in the area of the Reserve is mottled grey to yellow-brown duplex comprised of silty-clay and fine loam.

Vegetation

An analysis of the vegetation indicates the presence of three natural associations in addition to pasture land recently added to the Reserve. The factors underlying the differences in these vegetational types are primarily contour (i.e. height above creek level) and consequent effect upon water table depth, rather than any major differences in soil composition. As a result the vegetational types tend to merge into one another, however their approximate boundaries are illustrated in fig. 1. In fig. 1 and table 2 the four vegetation groups are listed as A, B, C and D, these are detailed below.

A. (plate 1) **Open-forest type I** (Specht 1970, L.C.C. 1973)

Where the creeks follow a single defined bed the original vegetation complex consists of the Manna gum, *Eucalyptus viminalis*, and Swamp gum, *E. ovata*, in association with Blackwood, *Acacia melanoxylon*, and Silver wattle, *A. dealbata*. In this habitat the lower storey is made up of such species as *Hakea nodosa*, *Bursaria spinosa*, *Cassinia aculeata* and *Coprosma quadrifida*. A few patches of this association still contain the tree-fern species *Cyathea australis* and *Dicksonia antarctica* growing along the creek banks. The ground cover is typically of ferns, including Fishbone water fern, *Blechnum nudum*, Common maidenhair, *Adiantum aethiopicum*, and Austral bracken, *Pteridium esculentum*, with various grasses. In some areas the ground is now dominated by Blackberry, *Rubus procerus*.

B. (plate 2) **Swamp association**

Through much of the southern portion of the Reserve the Cockatoo Ck. flows through wide soaks and braided channels. The widest of such areas is the Cockatoo Swamp at the extreme south

Plate 1 — (A) Open-forest type I, grows along much of Woori Yallock and Sheepstation Creeks. Shown here the trees are Manna gum and Messmate stringybark. Beneath these are Silver wattle, Blackwood, Cassinia and Coprosma.

Plate 2 — (B) Swamp association along Cockatoo Ck. A dense thicket of Swamp gum, Scented paperbark and Prickly ti-tree, with Common reed and various grasses.

eastern end of the Reserve. In these places the vegetation association comprises a dense growth of the paperbarks, *Melaleuca squarrosa* and *M. ericifolia* and ti-trees, *Leptospermum lanigerinum* and *L. juniperinum* with emergent *E. ovata*. The ground in the damper parts supports a cover predominantly of the Common reed, *Phragmites communis*, and *Blechnum nudum*, however slightly less wet areas are dominated by the Red fruit Saw-sedge, *Gahnia sieberana*, with Forest wire grass, *Tetrarrhena juncea*, and Sphagnum moss, *Sphagnum subsecundum*. In some places, such as the centre of the Cockatoo Swamp there are extensive beds of *Phragmites communis* with only occasional emergent trees *(E. ovata, Melaleuca* and *Leptospermum*). Whilst the basis of this community is a *Closed-scrub formation* (Specht 1970), some variety of structural form, due to varying degrees of seasonal waterlogging, is evident.

C. (plate 3) **Open-forest type II** (Specht 1970, L.C.C. 1973)

The slopes above the creeks still support a few uncleared patches of a dry sclerophyll forest. Almost all of this type is on private land outside the Reserve boundary, but was considered where it formed unbroken tracts in conjunction with the Reserve. It is dominated by Messmate stringybark, *E. obliqua*, and Narrow-leafed peppermint, *E. radiata*. Some retains an understorey of *Hakea nodosa*, bracken and occasional Small grass trees, *Xanthorrhoea minor*, however much of this forest has been subject to cattle grazing and has very little regeneration of the understorey except for areas now incorporated into the Reserve, which are beginning to recover.

D. **Alienated land**

Much of the Reserve, particularly portions recently purchased, is cleared and formerly was pasture. Scattered *E. viminalis* and *E. ovata* have remained along the creek frontages. These areas are at present in the process of being replanted with their original flora, and for the purpose of maintaining genetic integrity the Fisheries & Wildlife Division in co-operation with the Society for Growing Australian Plants is doing this using seed gathered from within the Reserve.

Species present

Fourteen species of reptiles, representing the families Elapidae, Scincidae and Chelidae have been recorded. Nine species of frogs representing two families, the Leptodactylidae and Hylidae, are also present (see table 1). A summary of the distribution of each taxon according to the available vegetation types is presented in table 2.

The so called 'cold blooded' creatures (ectotherms) possess no internal mechanism for the control of their body

temperature and it is governed by the temperature of their immediate environment. Terrestrial reptiles, however, are able to utilize one of two patterns of behaviour to achieve quite a high degree of thermo-regulation. *Heliotherms* bask in the sun to raise their temperature and retire to the shade to lower it. *Thigmotherms* do not bask but seek out areas of preferred temperature within the sheltered or shaded situations in which they live. Of the 13 terrestrial reptiles found at Yellingbo 11 are heliotherms while 2 of the skinks are thigmotherms.

Reptiles

The only species of snake encountered during the survey was the Copperhead, *Austrelaps superbus* (Lowland form of Rawlinson 1969) It was recorded very frequently and in all of the identifiable vegetation types.

Twelve species of lizards, all from the family Scincidae inhabit the Reserve. The most common species is the small

Table 1

REPTILES AND AMPHIBIANS RECORDED FROM YELLINGBO S.F.R.

Showing National Museum of Victoria registered numbers for voucher specimens collected during the survey.

Family: Elapidae	
Austrelaps superbus (Gunther) (Lowland form, Rawlinson). Lowland Copperhead	D55366-7
Family: Scincidae	
Anotis maccoyi (Lucas & Frost). McCoy's Skink	D55341, D55356-7
Egernia coventryi Storr. Swamp Skink	D55365
Egernia saxatilis Cogger. Black Rock Skink	D55351-2
Egernia whitii (Lacepede) White's Skink	D55364
Lampropholis delicata (De Vis). Delicate Skink	D55358-9
Lampropholis guichenoti (Dumeril & Bibron). Common Grass Skink	D55347-8, D55360
Lampropholis mustelina (O'Shaughnessy). Weasel Skink	D55349-50
Leiolopisma entrecasteauxii (Dumeril & Bibron) (Form A. Jenkins & Bartell)	D55344-5
Leiolopisma metallica (O'Shaughnessy). Metallic Skink	D55346-D55355
Leiolopisma trilineata (Gray). Three-lined Skink	D55361-3
Sphenomorphus tympanum (Lonnberg & Andersson) (Cool Temperate Form, Rawlinson). Southern Water Skink	D55342-3, D55354
Tiliqua nigrolutea Gray. Blotched Blue-tongued Lizard	D55353
Family: Chelidae	
Chelodina longicollis (Shaw). Eastern Snake-necked Tortoise	
Family: Hylidae	
Litoria ewingi (Dumeril & Bibron). Brown Tree Frog	D55323, D55329-30 D55332, D55334
Litoria raniformis (Keferstein) Bell Frog	D55310-11
Litoria verreauxi (Dumeril)	D55331, D55335
Family: Leptodactylidae	
Geocrinia victoriana (Boulenger)	D55317, D55321-2
Limnodynastes dumerilli Peters. Eastern Banjo Frog	D55314-6
Limnodynastes peronii (Dumeril & Bibron) Brown Striped Frog	D55328
Limnodynastes tasmaniensis Gunther. (Southern Call Race, Littlejohn). Spotted Grass Frog.	D55336
Pseudophryne semimarmorata Lucas. Southern Toadlet	D55312-3, D55320, D55324-5, D55333
Ranidella signifera (Girard). Common Eastern Froglet	D55318-9, D55327-8

Plate 3 — (C) Open-forest type II grows on slightly higher ground. The trees here are Messmate stringybark and Narrow leafed peppermint with Hakea and Austral bracken below.

Common grass skink, *Lampropholis guichenoti*, which is found in the litter layer of the Open-forest type II, the areas in and adjacent to the Open-forest type I association where the sunlight reaches the ground and also cleared land, provided there is access to shelter sites, in the form of logs, stumps etc. *Lampropholis delicata* is not common in the Reserve, but was recorded on eight occasions, all from slightly open patches in the Open-forest type I. Two species, *Lampropholis mustelina* and *Anotis maccoyi* are thigmothermic and were usually found only under fallen timber, often in quite damp and shaded situations on the floor of the Open-forest

Table 2

THE INCIDENCE OF INDIVIDUAL SPECIES WITHIN THE VEGETATION TYPES PRESENT
(See text for explanation of vegetation types).

Species	Vegetation types A	B	C	D
A. superbus	+	+	+	+
E. coventryi		+		
E. saxatilis	+	+	+	+
E. whitii		+	+	+
L. delicata	+		+	+
L. guichenoti	+	+	+	+
L. mustelina	+			+
A. maccoyi	+		+	+
L. entrecasteauxii				+
L. metallica	+			
L. trilineata			+	+
S. tympanum	+	+	+	+
T. nigrolutea	+		+	+
C. longicollis	(aquatic)			
L. ewingi	+	+	+	+
L. raniformis	+	+	+	+
L. verreauxi	+	+	+	+
L. dumerilli	+	+	+	+
L. peronii				+
L. tasmaniensis				+
G. victoriana	+	+		+
R. signifera	+	+		+
P. semimarmorata	+		+	+

type I. *A. maccoyi* was occasionally found under logs in cleared land and on two occasions animals were discovered moving over the substrate well away from any shelter, both on sunny afternoons in June 1980.

Specimens of the Metallic skink, *Leiolopisma metallica* were found infrequently. These were all in refugia in cleared, or partially cleared land immediately adjacent to the Open-forest type I. One of these specimens was found in winter under a piece of wood together with four specimens of *L. guichenoti,* one *L. mustelina* and one *Litoria verreauxi,* all in a torpid condition. *Leiolopisma trilineata* was also rather uncommon and most often was encountered in areas once cleared but now supporting a young regrowth of *Hakea nodosa, Leptospermum lanigerinum, E. obliqua* and *Gahnia seiberana.* Two specimens of *Leiolopisma entrecasteauxii* (Form A, Jenkins and Bartell 1980) were found on an old fence post standing in cleared pasture land, in July, 1979, to date no further animals have been located.

Three species of skinks of the genus *Egernia* and one of *Sphenomorphus* were found. These four skinks are similar in their moderate size.

The Cockatoo Swamp is of particular interest because these four species occur there in very close proximity. Around the southern margin of the swamp in the vicinity of Macclesfield Ck., *Egernia whitii* was seen basking in the entrances to burrows, probably constructed by yabbies *(Cherax sp.).* The vegetation here is either a regrowth, similar to that in which *L. trilineata* was found, or the interface between Open-forest type II and the swamp association flora.

The most significant finding of the survey was that of a colony of the Swamp skink, *Egernia coventryi* (plate 4). For many years this skink (known as *Egernia luctuosa)* was rarely recorded in Victoria. Whilst its preference for swamp/heathland was known all along, it was believed to be nocturnal and thus possibly thigmothermic. Rawlinson (1971 a, b) listed it amongst the heliotherms and Robertson (1980) has now improved our understanding of the animal and proven that it is a diurnal heliotherm. Despite this, and some recent additional distributional data, at present it is still only known from about twenty localities (Robertson 1980, Storr 1978).

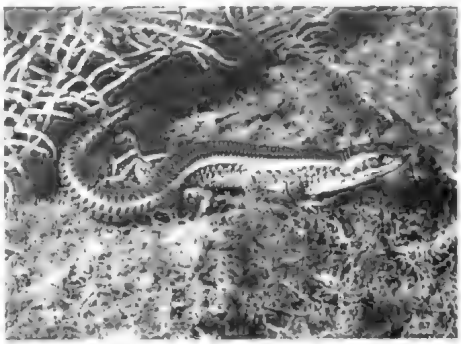

Plate 4 — *Egernia coventryi,* the Swamp Skink.

E. coventryi has been found at the extremities of Cockatoo Swamp and seems to inhabit its entire area, however the colony is particularly dense in an area along the north of the swamp. The vegetation in this specific area consists of the dominant tree species *Melaleuca squarrosa,* with some *E. ovata.* The Eucalypts here, however, have been severely infested with lerp insects (Homoptera, Psyllidae) in the past and consequently there is a great deal of fallen timber on the ground. The ground is covered with Sphagnum moss, *Sphagnum subsecundum* and there are many clumps of the Red fruit saw-sedge, *Gahnia sieberana.* Forest wire grass, *Tetrarrhena juncea* grows into tangles up to 1.5m high around the trunks of the trees. These grass masses, especially where they also contain a dead log or two, are the prime micro-habitat which the lizards use as basking sites and secondary shelter sites. *E. coventryi* is known to use burrows of its own con-

struction, as well as those made by other creatures (e.g. yabbie holes). The vicinity where these observations were made is riddled with small holes and the skinks use these as their prime refuge sites.

The abundance of dead timber around the northern perimeter of Cockatoo Swamp provides habitat for very dense populations of the Black Rock skink, *Egernia saxatilis intermedia*; and the Water skink, *Sphenomorphus tympanum* (Cool temperate form of Rawlinson 1969). *S. tympanum* occurs throughout the Reserve provided that solar radiation reaches the logs on which it basks. *E. saxatilis* does not have access to rocky outcrops here, rather it utilizes dry and cracked timber whether fallen or still standing, wherever such is found, and the killing of trees by lerp infestation appears to have been of direct advantage to this species.

The last four mentioned species present an interesting situation at Cockatoo Swamp. In the area of the confluence of Macclesfield Ck. with the swamp *E. whitii* and *E. coventryi* have been found within a few metres of each other and both species use yabbie burrows, it is not known what interactions occur between the two species. On the north side of the swamp *E. coventryi* is sympatric with *E. saxatilis* and *S. tympanum* and on one occasion in October 1979 specimens of all three were observed basking within two metres of each other on the same log. Again it is hard to know what sort of interspecific interactions are taking place between these animals. However *E. coventryi* does not compete with the other two species for shelter sites, using its terrestrial burrows, while they prefer splits and hollows in the timber.

In summer *Tiliqua nigrolutea*, the Blotched Bluetongue was observed throughout the Reserve in all of the vegetation types. On two occasions specimens were found in hollow logs during the winter.

The three creeks are part of the Yarra system in which only one tortoise species is known to occur, the Eastern Snake-necked tortoise, *Chelodina longicollis*. Attempts to collect specimens by the use of drum nets have not, to date, been successful. One female animal was found close to the Fisheries and Wildlife Division's office in early December, 1979, at least 300m from the nearest permanent water, and it is probable that it had just nested. This tortoise was found by Mr L. Willoughby, the Ranger-Naturalist at Yellingbo, he also reported sighting four further animals in a drying bow of the Woori Yallock Ck. in January 1980.

Goode (1966) states "While freshwater tortoises nest naturally and incubate under normal outside conditions in the River Murray area of Northern Victoria, and in Gippsland, the mean ground temperatures in the Melbourne area are too cold to permit natural incubation of freshwater tortoise eggs." Since the publication of that account this author has examined fertile eggs laid by *C. longicollis* on the banks of the Yarra and there is no doubt that a viable population exists throughout the Yarra drainage. Unfortunately, as a result of the Melbourne pet trade and its consequent introduction of many animals into the Yarra system, it cannot now be established whether or not a natural population existed prior to these introductions, and if so, whether the original stock of *C. longicollis* in this system was genetically closer to the Gippsland or the Murray/Darling drainage population.

Amphibians

The family Hylidae is represented at Yellingbo by three species presently included in the genus *Litoria*. The ubiquitous Brown tree frog, *Litoria ewingi* was found throughout the whole Reserve. *Litoria verreauxi* and the larger *Litoria raniformis* also inhabit all of the habitat types, although *L. verreauxi* was less frequently seen in the Open-forest type II. In summer adults of *L. ranifor-*

mis were observed basking on twigs and emergent plants above the water of slow moving parts of the creeks.

Six further species of frogs, members of four genera, are all from the family Leptodactylidae. *Limnodynastes dumerilli* was encountered throughout the entirety of the Reserve, frequently well away from open water in the forest litter layer. *L. tasmaniensis* (Southern call race of Littlejohn 1966) and *L. peroni* were under logs and flood debris in open pasture, but were not found in any forest situations. During both years *Geocrinia victoriana*, along with *Ranidella signifera* were very common everywhere, except the drier parts of the Open-forest type II forested slopes. *G. victoriana* particularly was evident during March and April when the males were calling. *Pseudophryne semimarmorata* was observed in all the areas of forest, including the Open-forest type II, as well as in former pasture adjacent to forest. It was never found anywhere but under logs, often together with *A. maccoyi*.

Species Not Detected During Survey

A number of species which may be present within, or adjacent to, the Reserve did not turn up during the course of the survey.

On the basis of the literature (Brook, 1975, 1979) all of the species of amphibians likely to occur here were demonstrated to actually exist at Yellingbo. A number of reptiles whose general distributions include Yellingbo were not found due to deficiency of suitable habitat, or for other reasons. These are summarised in table 3 as species which are unlikely to be found at Yellingbo. Some other species may yet occur here and perhaps were overlooked by this survey, they are listed in table 3 as those which possibly may be found in the future.

Of these two groups, some are worthy of mention. The Tiger snake, *Notechis scutatus* is known from many locations within the Yarra catchment, however there are some places where it is rarely, if ever, recorded (P. Brown, C. Logan pers. comm). Despite apparently excellent habitat, the large number of sightings of *A. superbus* make it seem probable that if any other large elapids were present they would have been en-

Table 3

SPECIES NOT DETECTED BY SURVEY

Elapidae		
Cryptophis nigrescens	Small-eyed Snake	+
Drysdalia coronoides	White-lipped Snake	+
Notechis scutatus	Mainland Tiger Snake	-
Pseudechis porphyriacus	Red-bellied Black Snake	-
Pseudonaja textilis	Eastern Brown Snake	-
Unechis flagellum	Little Whip Snake	-
Agamidae		
Amphibolurus muricatus	Jacky Lizard	+
Scincidae		
Leiolopisma coventryi	Brown Forest Skink	+
Lerista bougainvillii		-
Pseudemoia spenceri	Spencer's Skink	+
Tiliqua scincoides	Common Bluetongued Lizard	-
Varanidae		
Varanus varius	Lace Monitor	+

\+ Species possibly occurring at Yellingbo
\- „Species unlikely to occur at Yellingbo

countered. Therefore it is doubtful that *N. scutatus* is present at Yellingbo. People local to the area speak of 'black snakes', however no confirmed literature or museum records of the Red-bellied Black Snake, *Pseudechis porphyriacus*, are known for the area south of the Great Divide between Bacchus Marsh in the west and near Maffra in the east. Rawlinson (1971 a,b) has indicated this warm temperate distribution. All of the adult specimens of *A. superbus* examined were very dark slatey-black with orange colouration of the ventro-lateral region and their superficial similarity to *P. porphyriacus* would explain confusion between the two. These factors indicate that *P. porphyriacus* is not present at Yellingbo and that, for the present, verbal reports may best be regarded as referring to *A. superbus*.

The skinks *Pseudemoia spenceri* and *Leiolopisma coventryi*, inhabitants of separate microhabitats within wet sclerophyll forest, may be living in climax Open-forest type I at the south-eastern end of Sheepstation Ck., but they were not detected.

The Lace Monitor, *Varanus varius* is well known within a few kilometres both to the north and south of the Reserve. If it is present here it is probably only in places where Open-forest type II on private land is contiguous with the bush on the Reserve itself and provides sufficient area for the requirements of this large animal.

Zoogeography

On the basis of Rawlinson's (1969) division of the Bassian sub-region into three zones Yellingbo S.F.R. can readily be ascribed to the cool temperate zone. Whilst geographically the Reserve lies very close to the transition between warm temperate and cool temperate zones the reptile composition clearly shows a closer affinity to the cool temperate than either the warm or cold temperate zones. Data in table 4, adapted from Rawlinson (1971 a), demonstrates the above conclusion and also the greater influence of the warm temperate fauna in this area than that of the cold temperate. Only two species encountered in the survey are not listed by Rawlinson as cool temperate zone rep-

Table 4

ZOOGEOGRAPHIC DISTRIBUTION OF REPTILES RECORDED

	Warm temperate zone	Cool temperate zone	Cold temperate zone
Elapidae			
A. superbus (Lowland form)		+	
Scincidae			
A. maccoyi		+	
E. coventryi	+		
E. saxatilis	+	+	
E. whitii	+	+	+
L. delicata	+	+	
L. guichenoti	+	+	
L. mustelina	+	+	
L. entrecasteauxii		+	+
L. metallica		+	+
L. trilineata	+	+	
S. tympanum (Cool temperate form)		+	+
T. nigrolutea		+	
Chelidae			
C. longicollis	+		

tiles and these are the warm temperate *Egernia coventryi* (listed as *E. luctuosa*) and *Chelodina longicollis*. Both of these animals are dependent upon riparian habitat, *C. longicollis* being almost entirely aquatic, and their existence here in the cool temperate may be explained by their dependence upon warmer valleys within the zone. Since 1971 *E. coventryi* has been located at a number of other sites within the cool temperate zone (e.g. French Is., Wilson's Promontory, Noojee — P. Robertson 1980) and perhaps in the light of this further knowledge, its inclusion only in the warm temperate zone of Rawlinson's scheme may warrant review.

The amphibians of the Reserve are shown in table 5 according to the zoogeographic regions to which Littlejohn (1971) assigned them. The bias is clearly toward the Southern Bassian fauna, containing five species listed as exclusive to that zone and three species listed as 'wide-ranging' (i.e. encompassing both Bassian zones within their distributions). Only *Litoria verreauxi* is shown as primarily Eastern Bassian in distribution, however the data of Brook (1979) shows that this species extends from this zone somewhat to the west of Port Phillip Bay.

Conservation Value Of The Reserve

The significance of the Reserve from a herpetological point of view can be assessed from two angles, (1) the taxonomic diversity which it supports and (2) its value to individual species.

(1) *Taxonomic diversity*

The number of species present is good when the small size of the Reserve is considered. It undoubtedly reflects the variety of habitats available. Hutchinson (1979), who surveyed the reptiles of Kinglake National Park, 35km to the north-east of Yellingbo, found 19 species in an area of 5,800 ha, which encompassed 5 identifiable natural vegetation associations. At Yellingbo 14 reptiles were encountered in an area of only 340 ha, 5.86% of the area at Kinglake, and including 3 natural vegetation associations as well as alienated land. Of the species which occur at Yellingbo 10 (71.4% of the total) also occur at Kinglake.

Prior to the commencement of the survey a checklist of 9 frogs most likely

Table 5

ZOOGEOGRAPHIC DISTRIBUTION OF AMPHIBIANS RECORDED

	Southern Bassian	Eastern Bassian	Wide-ranging
Hylidae			
L. ewingi	+		
L. raniformis			+
L. verreauxi		+	
Leptodactylidae			
L. dumerilli	+		
G. victoriana	+		
L. peronii			+
L. tasmaniensis (Southern call race)	+		
P. semimarmorata	+		
R. signifera			+

(Tables 4 and 5 — Data adapted from Littlejohn and Rawlinson (1971). See text for explanation of nomenclature.)

to be collected at Yellingbo was drawn up from the literature (Brook 1975, 1979, Littlejohn 1963, 1971, Barker and Grigg 1977). As can be expected from the riparian nature of the Reserve, frogs abound and in fact the full complement of expected species was discovered.

On the basis of this analysis it may be said that despite its small total area and narrowness, the Reserve is maintaining a good herpetofaunal variety.

(2) *Significance to individual species*

The Reserve may only be considered of particular conservation value to *Egernia coventryi*. All of the other species discussed here are quite widespread and at present are in no way endangered. The colony of *E. coventryi* may well be one of the largest in existence. It appears to take in the whole of Cockatoo Swamp (approx. 50ha) and this is presently under investigation. Of the other known collection sites for this lizard two are within National Parks, at Mallacoota and Wilson's Promontory and one is within French Is. State Park. Many of the other locations are on private land and hence provide no guaranteed habitat protection. With the exception of the Yellingbo and Boneo colonies, at none of the sites have more than half a dozen specimens been observed or collected and some of them are represented by single animals only. More colonies may be found in the future, however their swamp land habitat has been extensively cleared and drained throughout much of Victoria. The Yellingbo S.F.R. is therefore considered to be of significant value in the conservation of this most attractive skink.

Reserves, Shapes And Sizes

From the foregoing results some generalised comments can be made in relation to the size and shape of a reserve such as Yellingbo. Yellingbo State Faunal Reserve is a riparian habitat and its prime purpose is the conservation of a riparian species, the Helmeted Honeyeater, this fact, together with the history of settlement of the surrounding district has necessitated it being in the shape of thin strips of land.

A number of authors have commented that long, narrow strips of land are not ideal for nature reserves. (Diamond and May 1976, Winter 1978, Frankenberg 1971 and Hastings 1977, the last 2 authors specifically mentioning Yellingbo). This is due to the considerable effects upon such a reserve of management practices carried out upon land outside and abutting the reserve boundary. Also dispersal distances of fauna within the reserve are seriously confined.

Whilst the herpetofaunal variety is good, for animals of small body size at least, some correlation between the number of species present and the width of the Reserve at a given point seemed to be manifest. Certainly the vicinity of Cockatoo Swamp, the widest part of the Reserve and an area where much of the surrounding freehold, at present supports bush contiguous with the Reserve (Fig.1), has more species than were observed in other comparable but narrower areas. No quantitative assessment of this was made but two of the larger skink species, *E. coventryi* and *E. whitii* were not found outside this area. Studies by Stebbins and Barwick (1968) demonstrated the large distances and area which may be covered in the daily activity of an adult Lace Monitor, almost without doubt, if this species does occur within the Reserve it will only be in a place or places where the adjoining freehold is naturally timbered and will thus provide sufficient space for such an animal.

It may be argued that a greater number of species present in a wider area of reserve, like the Cockatoo Swamp, may simply reflect the greater variety of microhabitats available, but perhaps therein lies its value.

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Naturalist Review

"Dinosaurs"

BY L. B. AND JENNY HALSTEAD

Blandford Colour Series, Blandford Press, Poole, UK 1981. Recommended Retail Price $15.50. ISBN 0 7137 1154 X. Review copy supplied by Australia and New Zealand Book Co., Pty. Ltd.

These two books in the Blandford Colour Series have very little in common — they differ markedly in quality and, I suspect, their intended audience. *Dinosaurs* commences somewhat pretentiously with the author stating his book "provides the most comprehensive survey of these ruling reptiles" and that "it will serve as an encyclopaedia of dinosaurs". These are almost impossible objectives to attain in a 170 page paperback! Nevertheless the work is obviously scholarly, recent and well written. Its cost seems to pose the main deterrent to would-be purchasers. Its level seems most appropriate for

"Wild Animals of The World"

BY MAGGIE O'HANLON AND DOREEN

Blandford Colour Series, Blandford Press, Poole, UK 1981. Recommended Retail Price $9.50. ISBN 0 7137 1145 0. Review copy supplied by Australia and New Zealand Book Co, Pty. Ltd.

naturalists and students with some biological knowledge who would prefer not to delve into the appropriate scientific literature in order to ascertain information on the most successful land vertebrates that have ever lived.

This last aspect needs stressing. Dinosaurs ruled the land for over 140 million years. (They were also important faunal components of the aerial and aquatic habitats). They outcompeted (completely) the contemporaneous marsupials until the dinosaurs' mysterious extinction 64 million years ago. And yet people still talk of dinosaurs as evolutionary failures!

Our knowledge of dinosaurs is expanding rapidly. Over 800 species have been described world-wide. In Victoria, only one fossil dinosaur remain had been found prior to 1978 (the famous Cape Patterson Claw in 1906); since then hundreds of their bones have been unearthed. Interest in dinosaurs is still high. The local press recently reported that the National Museum of Victoria plans to display the enormous *Mamenchisaurus* skeleton from China in early 1982. This dinosaur is described and sketched in *Dinosaurs*; interestingly it had the longest neck of any known animal and is thought to have held it out horizontally rather than use it as an aid to feeding off high foliage.

Dinosaurs begins with an interesting historical account of the early discovery of dinosaur fossils and is followed by a brief resumé of dinosaur origins, radiation and classification. The major part of the book is devoted to a description of dinosaur groups (32 families) accompanied by colour drawings of over 100 genera. These are of high quality and doubtless contribute much to the cost of the book. The book "closes with a critical view of the various theories that have been put forward to account for their (dinosaurs') extinction . . ." I feel many readers will be somewhat disappointed with this "review" — insufficient evidence is presented to allow the reader the opportunity of speculating on one of the most baffling riddles confronting biologists today.

There are some other weaknesses in the book. Halstead claims to present "the latest results of research into the behaviour and physiology of dinosaurs", yet barely mentions many of the exciting and significant discoveries of the last decade. The work of Ostram and Bakker on dinosaur activity patterns, community relationships and thermophysiology is dismissed in half a page. Another weakness is the lack of a suitable bibliography for those interested in reading more widely (or deeply) in the field. Despite these flaws, however, the book is well presented and written by a scientist who obviously knows (and seems to enjoy) his work!

The same cannot be said for *Wild Animals of The World*. This book seems to be directed at children or adults with very little knowledge about mammals (these are the only animals considered). It aims to exemplify the types of mammal found in a number of biomes (polar; coniferous forest; deciduous forest, Mediterranean scrub and evergreen forest; grasslands; deserts; tropical rain forest; mountains; oceans) in each of the biogeographic zones — North America, Eurasia, Orient, South America, Africa and Australasia (which includes Australia, New Zealand and Tasmania!)

Unfortunately the book fails on a number of counts. By only considering some animals from each zone within the biomes, readers who are unfamiliar with the habitat described gain little overall appreciation of its community structure or ecology. Another fault is its lop-sidedness. Thus Australia's grasslands are represented by the Quokka, Crest-tailed Marsupial Mouse (incorrectly named *Sminthopsis crassicaudata*), Red Kangaroo, Grey Kangaroo, Echidna, Potaroo (sic), Hare Wallaby, Brush-tailed Rock Wallaby, Red-necked Wallaby and Hopping Mouse. (Many of these are clearly not grassland dwellers). On the other hand, there are no Australasian examples given for deserts or mountains. Many biologists have recently noted the paucity of Australia's grassland mammals in contrast to other continents. Our marsupials seem most diverse in temperate woodland and open-forest, while most species of our rodents (27%) are found in desert associations. Clearly this book does not reflect such preferences.

The book's major fault is its large number of errors. Almost every description of Australian mammals contains errors — from using well out of date scientific names to the drawing of the Quokka as a swimmer with four equal sized legs. We are told *Trichosurus* is an opossum, that the Northern native cat *Dasyurus* (called *Dasyurops)* is not a mar-

(Continued page 253)

Field Notes On The White-footed Dunnart, *Sminthopsis leucopus* Gray (Marsupialia:Dasyuridae)

By R. J. Cheetham* and R. L. Wallis*

Introduction

The White-footed Dunnart (*Sminthopsis leucopus*) is a small, insectivorous, dasyurid marsupial which occurs on Flinders Island and other parts of Tasmania, and on the mainland is restricted to coastal regions from western Victoria to southern New South Wales. Although once considered rare in Victoria (Frankenburg, 1971), Morton, Wainer and Thwaites (1980) noted that *S. leucopus* has been more frequently trapped recently and that it might not be as uncommon as once thought. However, trap success rates of *S. leucopus* have always been consistently low; for example, 0.07% (Green, 1972), 0.2% (Callanan and Gibson, 1977), 2.6% (Nicol, 1978), 0.5% (King, 1980) and 1.2% in this study. Use of techniques such as predator scat analysis and pitfall trapping in the future may resolve the question of the species' rarity.

Little is known of the field biology of *S. leucopus*. Morton *et. al.* (1980) published some information on its preferred habitat in Victoria (including details on vegetation structure, rainfall and soils) while Green (1972) and King (1980) described trapping sites in Tasmania and New South Wales respectively. Hyett and Shaw (1980) discussed the species' diet and noted that breeding probably occurred in spring with a resultant litter of eight.

This paper reports on aspects of the field biology of *S. leucopus* gained from an eighteen month trapping study.

Study Site

A trapping grid was set up on private property abutting Tarango Road, Yarra Junction, 56 km east of Melbourne. The upper canopy consisted of *Eucalyptus dives* and *E. radiata* and the middle stratum contained *Hakea teretifolia, Banksia marginata, Acacia* spp., and *Leptospermum juniperinum*, and the ground cover *Gahnia sieberiana, Pultenaea gunneii, Poa australis, Drosera* spp., and *Adiantum* spp. The soil was a skeletal yellow podzol. The area has not been burnt for many years; local inhabitants state their only recollection of fire was in 1939 when the whole area was razed.

Trapping

Ninety folding aluminium Elliott traps (32 x 10 x 9 cm) were baited with a mixture of peanut butter, rolled oats and honey and set at dusk and cleared at dawn about every three weeks from September 1978 to April 1980. The traps were set in nine rows (7m apart) at 3m (and later at 6m) intervals.

Results and Discussion

Sminthopsis leucopus can be distinguished from *S. murina* by the presence of transversely striated, elongated apical granules on three interdigital pads of the hind feet. Other distinguishing characters include molar length and pes width and length (Morton, *et. al.*, 1980). Using these criteria, the Yarra Junction dunnarts and a recently collected road kill from Wonthaggi are clearly *S. leucopus*. The localities also fall within the range of *S. leucopus* described by Morton *et. al.*, 1980, who have recorded a specimen from Narbethong, some twenty km east of Yarra Junction.

S. leucopus occurs in a variety of habitats. On the mainland, they live in tussock grassland and sedgeland near the coast, in scrub and heath (with a

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good mid-storey cover) or in woodland and open forest providing there is good cover from a scrub or heath understorey (Morton *et. al.*, 1980). King (1980) has trapped *S. leucopus* in a floristically complex coastal heathland with sparse cover at Jervis Bay, and Lee (pers. comm.) obtained specimens from sites in the Otway Ranges which show regeneration following some previous disturbance. Green (1972) has reported captures of *S. leucopus* in Tasmania from both coastal heath and sub-alpine rainforest dominated by *Nothofagus*.

Seven *S. leucopus* (two males, five females) were trapped. Female #3 was trapped 13 times over the 13 months while two animals (male #4, female #7) were trapped only once. Males were only taken in September, October and November of 1978. No *S. leucopus* were trapped from November 1979 till the completion of the study the following April, despite saturation trapping (200 traps) twice in this latter month. The month in which most *S. leucopus* were caught was March (4 animals), and three captures were each made in April, May and June. Apart from female #3 which was not trapped on only three occasions prior to December 1978, the other dunnarts seemed to be trapped in sequential sessions then disappear from the trap record. Thus female #5 was trapped four times from February till April, but not thereafter, and female #6 four times from April to June only.

The observed range lengths (Stickel, 1954) of these three most frequently trapped females were 120, 62 and 55 m. When plotted on a map of the trapping grid home ranges of the females show considerable spatial overlap but females trapped on the same night occupied traps at least 20 m apart. In September, 1978, a male and female *S. leucopus* were taken in traps only 3 m apart.

The range and mean body weights of individual *S. leucopus* are given in Table 1. Animal #6 showed a weight loss from 20 g during April and May to 15 g in June. Other animals captured more than once either maintained or increased in weight. The mass of one female (#3) increased from 22 to 30 g, the higher values being when she carried five pouch young. This animal gave birth between successive capture dates of 26/ix/79 and 19/x/79. On this latter day, the young were each about 5 mm long and two weeks later they had grown to about 8 mm, but were still unfurred and pink. All female *S. leucopus* had ten teats.

Tyndale-Biscoe (1979) has suggested that *Sminthopsis* species are strictly terrestrial and seasonally polyoestrous and thus differ from *Antechinus* species which are scansorial and monoestrous. This seems to be an over-simplification; *S. leucopus* has been reported to climb

TABLE 1

Number of capture, range and mean of the *S. leucopus* trapped during the study.

Animal number	Sex	Number of captures	Range in body weight (g)	Mean body weight (g)
1	M	2	21	21
2	F	2	23-20	21.5
3	F	13	30-20	24.7
4	M	1	22	22
5	F	4	20-19	19.5
6	F	4	20-15	18.7
7	F	1	—	—

trees to feed and have been found in a nest 45 feet up on a gum tree (Sharland, 1972). Morton, *et. al.* (1980), considered that the striated foot-pads of *S. leucopus* may be related to their scansorial habits. Not all *Antechinus* species are monoestrous (or show post-mating male mortality). Finally, Lee, Woolley and Braithwaite (in press) believe *S. leucopus* differs from other species of *Sminthopsis* in that it is monoestrous with a restricted, seasonal breeding pattern (although males probably live for more than one year).

Female #3 gave birth between 27/ix/79 and 19/x/79. New-born young of *Antechinus* spp. are about 4.5 mm long (Marlow, 1971; Williams and Williams, in press). If we assume similar sizes of young of *S. leucopus* at birth (which may not be valid), we assume birth occurred on about 12/x/79.

Gestation period in *S. leucopus* is unknown, but that in other dunnarts is between 12 and 16 days (Godfrey, 1968; Fox and Whiteford, in press). Given a similar value for *S. leucopus*, female #3 in this study must have mated late September. Such an assumption, however, is again only speculative, particularly considering the monoestrous habit of the White-footed Dunnart which contrasts the pattern in other species of *Sminthopsis*. Green (1972) has reported a female *S. leucopus* captured near Binnalong Bay, Tasmania which carried eight pouched young about 12 mm long when it died on 21/x/70, and on this basis concluded that breeding occurred in late spring (actually to the end of September). If breeding is as seasonal in this species as it is in *Antechinus* spp., then it seems breeding occurs at the same time in Victoria and Tasmania. This contrasts the situation in *A. swainsonii* and *A. minimus*, both of which breed later in Tasmania than on the southern mainland (Green, 1972; Reed and Wallis, 1975; Wallis and Baxter, 1980).

Female *S. leucopus* in this study had ten nipples. In Tasmania, Green (1972, p. 27) found a subadult female to have "at least eight faintly developed nipples". The previously mentioned Binnalong Bay specimen also had eight nipples. In Tasmania *A. minimus* females also have two fewer teats than their Victorian counterparts (Wallis and Baxter, 1980).

Ectoparasites include the mite *Mesolealaps sminthopsis* (Womersley, 1954), a louse (possibly a Boopiid) and the tick *Ixodes tasmani.*

Acknowledgements

We wish to thank the Boys Brigade of Victoria and Mr Sutton-Smith for access to the study site and Dr D. Murray, Dr D. H. Kemp and Dr R. Domrow for examining the ectoparasites. We also wish to thank Professor A. K. Lee for his constructive suggestions about the manuscript. Trapping was carried out under a permit issued by the Fisheries and Wildlife Division, Ministry for Conservation.

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Cinnamon Fungus

By Cecily Falkingham*

Victoria is in the grip of the dreaded Cinnamon Fungus — *Phytophthora cinnamomi.*

Cinnamon Fungus was first discovered in Java in 1922 in the bark of cinnamon trees. It is now known to be widely scattered throughout the world, and has caused serious problems in native forests, plantations, orchards, home gardens and nurseries.

Trees have been dying from this disease in jarrah forests in Western Australia since approximately 1921 but the cause was not discovered until 1965. In Victoria patches of forest were seen dying back in early 1950 but it was not known that the reason was probably Phytophthora until 1969.

The Cinnamon Fungus feeds on the fine roots of susceptible plants, rotting them. This reduces the hosts ability to obtain moisture and nutrients from the soil. In Summer when the soil is dry, plants may die quite suddenly or may die back gradually from the tips. Hence the name — "die-back" as some people refer to it. Plants that grow in shallow soil will show signs of the disease before the same plants growing on deep moist loam.

In Victoria, Stringybark Ash and Peppermint type eucalypts and the understorey plants associated with them, as well as the heaths, grass trees, coastal shrubs and tea-tree swamps, where the soils are shallow, drainage poor or impeded, are susceptible. Unfortunately no eucalypt has been found entirely resistant, but most of the gums, boxes and iron-barks are very tolerant.

In Victoria, as in Western Australia, logging has contributed to the dieback problem. The nearly total destruction of plant species in vulnerable areas of native vegetation has led many plant pathologists throughout the world to recognize Cinnammon Fungus as the worst plant disease ever recorded. Whereas other fungus diseases may attack one or two hosts (such as the Dutch Elm disease) the Cinnamon fungus has nearly a thousand hosts. Australian natives are the most susceptible, but hosts include such exotics as pineapple and avocado crops, peach orchards, and garden plants such as rhododendrons and azaleas.

Research in Australia and overseas shows that Cinnamon Fungus is generally most destructive when drought follows a period of warm wet weather. The warmth and moisture encourage rapid production of zoospores. Large-scale destruction of roots follows, and then the drought places the plants under stress that they cannot cope with because of their reduced root complement.

Infection occurs when conditions in the soil are sufficiently wet and warm (above about 15 deg. C), Temperatures below 5 deg C can kill the fungus. The combination of these two limitations, together with other important environmental factors such as soil type, soil microflora, soil fertility and the particular vegetation association result in only a relatively small proportion of our forests being located on high hazard sites.

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The situation in the Brisbane Ranges more closely approximates that in Western Australia. In the Brisbane Range National Park, where the once tall proud beautiful *Xanthorrhoea australis*, (grass tree) was one of the most beautiful features of the park, now the grass trees are in various stages of ugly decay. The trees' foliage turns yellow first then a rich cinnamon brown, then the whole crown inverts and wilts and within 6 months only the stump remains. Instead of the flower spike standing straight and tall it wilts over, bent in a pathetic crook, giving the area an appearance of gloom and desolation. (It is important to mention at this point that not all species in the genus are equally susceptible. For example, *Xanthorrhoea minor* is tolerant).

The fungus is now quite widespread, being found in the Grampians, Wilsons Promontory, East Gippsland as well as suburbs of Melbourne. (Because the zoospores of the fungus require a saturated soil to assist their spread and come in contact with the fine root systems of susceptible host plants, artificially irrigated areas such as home gardens can also be affected particularly if they are overwatered).

The spongy roots of Banksias are particularly susceptible to attack; their matted roots appear to assist the progress of the disease. Anyone reading this article who has Banksias in their garden will know the number of honeyeaters that rely on this plant or may have observed the constant visitation of these birds in the bush. Maybe like myself you have marvelled at the amount of insect life that gathers over some of our flowering shrubs, supplying protein as well as nectar to the birds' diet. The Banksias and other native plants are essential for the survival of many forms of animal and bird life.

Well what can we do, the outlook is pretty gloomy, step one is to be aware of what does spread the disease. A senior Melbourne University Botanist, Dr Gretna Weste has this to say — "Cinnamon fungus is most commonly dispersed in soil or gravel. It is spread about by roadmaking, earth-moving equipment and particularly by off-road tracked vehicles. Commonly, infected soil or gravel carrying the pathogen is deposited in roadside heaps. From there it is dispersed in water-run-off downhill. Soils which are shallow and poorly drained and soils that have a clay pan near the surface rapidly waterlog, rapidly dry out and contain a dense mat of plant roots for the fungus to attack".

In dry conditions, another kind of spore is produced, these are called resting spores, they have a tough outer layer that helps keep them intact for years. Heaps of roadside gravel infected with cinnamon fungus have been found to yield these resting spores after five years of inactivity. Once a gravel pit becomes infected with fungus, then not only are spores deposited with the material wherever it may be used, but machinery using the pit will transmit the organism to other pits in which they may be working. Machinery called up to fight fires has carried the infection over long distances. Soil cakes around axles and wheels. A large bulldozer working in muddy conditions may transport up to half a ton of soil from place to place.

Unknowingly, nurseries distribute plants growing in contaminated earth. Present knowledge seems to indicate that once the fungus has become established at a site, it is there permanently.

There is no cure for infections of open bushland. Already valuable Flora has disappeared from infected areas and consequently so does Fauna, but planting and seeding trials in Gippsland by the Victorian Forests Commission give ground for some optimism that, in contrast to the situation in the jarrah forest, the original species can be re-established on die-back sites there, although possibly not on the most severely affected sites. However, most of the trials began after 1971, and only time will tell whether re-establishment will succeed in the long run. The Commission is trying out various combinations of endemic species, and different tree-establishment techniques, in these trials. In other experiments, Commission scientists are seeing whether genetic variability within species can be used to assist re-establishment of the original species on severely affected sites. Seeds from trees that have remained healthy-looking in dieback areas have been propagated in glasshouses, and the young plants tested for susceptibility to *Phytophthora* attack. The results indicate that genetic differences do make some plants more tolerant of the fungus than others. Trials to test this tolerance in the field have begun.

Dr Gretna Weste has these suggestions to delay and reduce and possibly prevent this destruction of our beautiful bush areas, some

of which are our most valuable National Parks. "1. By transporting and using clean soil or gravel. 2. Pressure hosing all vehicles and equipment in contact with soil or plant roots *before* these leave a diseased area. 3. By planting disease-free nursery stock."

I suggest you check with your nursery *before* buying plants that his soil has been disinfected. Most big nurseries treat their soil with steam or fungicides.

Also before buying soil for your garden make sure if possible, where you are buying it, that the establishment has obtained the soil from a disease-free area or that the soil has been disinfected.

In Victoria there is an urgent need for *total* Government action to prevent Cinnamon fungus from reaching dry scherophyll forests still free of the disease, and road contractors should contact local forest officers for information on the *known* distribution of the fungus in an area where they are working.

The Victorian Government proclaimed Forests Regulations in 1973 aimed at prevention of die-back. Under these regulations quarantine zones have been formed to protect two areas of valuable forest in Gippsland.

What can we do? The average person who loves his day in the bush and all the joy it brings. For a start, don't drive off roads into the bush, this causes vegetation damage, erosion, weed invasion etc.

Don't dig up plants for your garden, in doing so you transmit the organism from one spot in the bush to another, and also you may ruin your own garden.

Tell others about the problems the fungus is causing. It is only when people are widely informed that proper precautions will be taken.

Inquiries regarding the infection of natural bushland I found very adequately handled by The National Parks Service. They are spending a lot of time and effort in making sure their own vehicles are not spreading the disease and great care is being taken within the parks not to make the situation worse. It is areas outside of National Parks that are the biggest threat, simply because it is not always known by the general public where such areas are and what to do.

Inquiries concerning the infection of home gardens, nurseries and horticultural plants should be directed to the Victorian Plant Research Institute, Department of Agriculture, Burnley, Victoria.

The Forests Commission, through its Extension Branch, provides a comprehensive service to both the metropolitan and rural public on all aspects of tree growing, and advice can be obtained by writing or phoning the Chief Forest Extension Officer. The Commission also provides a P.c.soil testing service to other Departments, including the National Parks Service, and to the public for a small fee.

There is unfortunately no magic cure for Cinnamon fungus, only control by regulations, and our awareness of the problem is a positive step toward prevention.

Acknowledgements: to Dr Gretna Weste and Barrie Dexter.

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(Continued from page 247)

supial but a member of the Carnivora and that the flying foxes are not bats but instead Insectivores. They perpetuate several old myths scientists have been putting to rest for years — that marsupials are physiologically less advanced than eutherians, that marsupials represent an intermediate stage in mammalian evolution and that large macropods cool themselves by licking their fur. Finally, I doubt if the artist has ever seen most of the Australian mammals if we are to judge her drawings and their lack of similarity to the true beast.

R. L. WALLIS

Erratum

Volume 98 (4) p. 146; line 4, column 2, "Hungry Head".
P. 149, line 9, column 1, "Table 1".
P. 151, after line 7, insert.

A. australasiae appears to be an active and wary insect and flies away at the least disturbance.

Delete "recorded . . . approx —." (lines 8,9).

In the same issue it was erroneously reported (p. 178) that Mr Ros Garnet had been a member of the management committee of Wilsons Promontory National Park. Mr Garnet wishes to note that this is not so.

A Short History Of The Discovery And Naming Of Banksias in Eastern Australia
Part V Ferdinand Mueller

By A. I. Salkin*

Of all the botanical collectors so far discussed none were permanent residents of Australia, though some of them like Robert Brown, George Caley and Alan Cunningham spent a considerable time here. It was only Mueller, in this early period, who came to Australia as a young man and spent the rest of his working life in this country. One other point is worthy of mention: Mueller did not collect in Australia primarily to send material to Europe. The major part of his collecting was for the establishment in Australia of a National Herbarium. In his first report (Mueller, 1853) to Governor La Trobe his instructions and his intentions are quite clear.

"In accordance with His Excellency's instructions, a collection of dried specimens of plants has been commenced for the Government. This Herbarium will be at all times accessible to the public, and will hereafter contribute, I trust, to diffuse, more and more, knowledge of our vegetable world, and excite lovers of natural science to assist in my investigations. I began to form, at the same time, a similar collection for the Royal Gardens at Kew."

He does not mention here that he was also contributing to another European collection, that of his friend Dr Otto Sonder.

Mueller's appointment marks a change in the science of Australia. There is the obvious intention with this collecting, to work up the collections and to publish in Australia the names of new species, indeed in the same report of 1853 he published the names of 215 new species in his first "Systematic Index of The Plants of Victoria". These were collected and examined between September 1852 and August 1853.

In this first report he details a journey he undertook from Mt Buller to Gippsland. As the weather in the Alps was wet that autumn, instead of looking at the high Gippsland mountains, he proceeded by way of the Latrobe River to Wilsons Promontory where he spent several weeks. The systematic index lists five *Banksia* species. These are *B. australis (B. marginata), B. verticillata, B. integrifolia, B. serrata* and *B. prionophylla*. Only one is a new species name and this is *B. prionophylla*. The National Herbarium of Victoria has a specimen (MEL 52602) and this is very typical of what was regarded by both Bentham (1870) and Ewart (1931) as *B. collina*.

Mueller was very much aware of the problems of phenotypic or environmental variation although he did not call it such. Commenting on this in his first systematic index (1853) he writes —

"The index might have been increased without difficulty to a two fold number of names; but through a long continued examination of the Australian plants in the living state, I had the advantage of learning how great is the uncertainty of many characteristics, which are deemed, even by our greatest authorities in science, sufficient for distinction."

The specimen has a Mueller collection slip, as well as a Sonder Herbarium slip. The slip in Mueller's handwriting bears

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the following inscription —

"Banksia prionophylla
Ferd Mueller
B. cunninghamii
Sieber?
Austra felix"

A second specimen without a Sonder label but with a Mueller slip with a Latin diagnosis has the species name "B. cunninghami" (sic) and the location in full "Australia Felix". "Australia Felix" refers to the country that the New South Wales Surveyor-General, Major Thomas Mitchell had crossed from Swan Hill to the Glenelg River in 1836. This was the country that Mueller first crossed by way of the Futters Range near the present town of Glenrowan and the May Day Hills near Beechworth.

The only place in this area where he could have collected *B. prionophylla* was on his journey from Melbourne north over the divide. He notes in his first report (Mueller, 1853), "I proceeded at first with deviations from the usual road wherever it appeared favourable for my pursuit." *Banksia prionophylla* grows in the vicinity of Mt Slide and it may have been here where he collected it on the edge of Australia Felix. The more likely explanation is that he collected it, together with *B. integrifolia* which bears the same location, at the end of his journey, at Wilsons Promontory where both species are extremely common. Australia Felix was for him at this period all Victoria.

Mueller was a personal friend of Dr Otto Sonder and sent him duplicates of his collections. Sonder for his part made available, what was probably the largest herbarium in Europe to other botanists for study. Among these was Carl Friedrich Meissner* who specialised in the Proteaceae and was the first to describe many of the Western Australian species of Proteaceae. Meissner described *B. prionophylla* from the very long juvenile leaves of the specimen sent by Mueller and as was his practice used Mueller's manuscript name (Meissner, 1854).

Mueller by this time had changed his mind about the identity of the Victorian population. Two further collections, the Melbourne collection and the Sonder duplicate, from Sealers Cove, Wilsons Promontory, are labelled "Banksia cunninghami (sic) Sieber". This collection would have been made in 1854 after his abortive attempt to climb Victoria's highest mountains between November 1853 and April 1854 (Mueller, 1854a) and before his third long journey which began in November 1854 (Mueller, 1854b) when he ascended Victoria's highest mountains.

Mueller was correct in his first diagnosis of Victorian populations. These, although related to *B. cunninghamii* which is a New South Wales deme, are sufficiently different and isolated from those populations for genetic drift to have occurred. These differences only become evident when the plants are grown experimentally and phenotypic variation is kept to a minimum.

The species that Mueller described as *B. verticillata* could not be that species because it only occurs in a few locations, notably in the vicinity of Albany W.A. but Mueller did recognize that it was a species that differed from the coastal *B. integrifolia.* Recent collections from Wilsons Promontory show that this species is similar to a form that also grows in The Grampians mountains of Western Victoria.

Mueller's second report (1854a) was concerned with his second long journey covering 4,000km and lasting 5½ months. It was on this journey that he attempted to ascend some of the highest mountains in Victoria (Barhard, 1904) but was driven back by bushfires.

He began this journey by first visiting The Grampians and the Mallee and collected *Banksia ornata* at Mt Zero. This

* Meissner originally spelt his name Meisner. His publications use the spelling with the double s.

species was described in Linnaea (Meissner, 1854) by K. F. Meissner using Mueller's manuscript name. Mueller had collected *B. ornata* previously when he was in South Australia. Meissner's description is based on material that was collected in The Marble Range near Port Lincoln S.A.

From the Mallee, Mueller followed the Murray to its junction with the Mitta Mitta and this gave him access to the highest Victorian mountains.

At the headwaters of the Mitta Mitta he collected a further *Banksia* species. The collection has the original collecting slip which described it as *"Banksia insularis* Br." It is recorded as being "in mountains also on slopes Mitta Mitta" and is signed "Dr Ferd. Mueller". A later label in clear copperplate writing reads *"Banksia insularis* R. Brown Mountains on the Mitta Mitta". The collection consists of adult leaves and a flower in bud but does not include a cone which is the most important diagnostic clue to this species. Mueller, like Brown, was aware of the enormous variation in *B. marginata* for in "Plants Indigenous to the Colony of Victoria" (Mueller 1860-1862) which was eventually published in Ewart's "Plants Indigenous to Victoria" Vol. 2 (Ewart, 1910) he illustrates 10 leaf forms, one of which could be *B. canei.*

Mueller brings to an end the early phase of collecting. It was his perceptiveness that enabled him to distinguish plants that were worthy of collecting. Not one of the four new banksias he collected was described by him. *B. ornata* and *B. prionophylla* were described by Meissner. *Banksia canei* was described in 1967 (Willis, 1967) and the other one will probably be described in a revision being carried out by A. S. George (personal communication). There is however, one other species that Mueller was aware of, and neither named or described, probably because of his other commitments at this stage of his enormously busy life.

In 1867 Mueller's collector Dallachy, who collected mainly in the Rockingham Bay area near the present township of Tully in North Queensland, wrote to him about, and later sent him, two specimens of a new *Banksia* species. Dallachy regarded them as two variants of the same species. His notes on the specimens as far as I can translate his handwriting are as follows —

"This is the Banksia I wrote to you about in my last letter. It is pale blue flower head. It is a dwarf plant about 2-3 feet. I only saw a few of it. I only got two seed pods of this Banksia. I do not know whether it is different from the one on the ranges in general, perhaps it is because it is more exposed to the cold weather. None seem to be in flower at present."

Both specimens have coarsely serrated leaves and one specimen has a flower in bud. They are like no *Banksia* species that I know, particularly if the height is correct. The thought comes to mind that this may be a *Banksia* species that is "lost", and with the destruction of the forest in that area may never now be found.

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Differentiating the Left-handed Freshwater Snails of South-eastern Australia

BY BRIAN J. SMITH AND RHYLLIS J. PLANT*

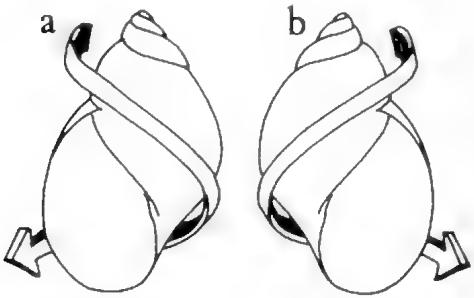
South-eastern Australia has a large and varied freshwater snail fauna (Smith and Kershaw, 1979) ranging from a wide series of small black operculates, family Hydrobiidae, to planispiral shells, family Planorbidae (part), dextral or right-handed high-spired shells, family Lymnaeidae and a series of sinistral or left-handed high-spired shells belonging to the families Planorbidae (part) and Physidae. In the helicoid, high-spired shells, the direction of coiling can be determined by holding the shell with the spire up and the aperture facing. Dextral or right-hand coiling shells have the aperture to the right of the median axis, sinistral or left-hand coiling shells have the aperture to the left of the median axis (Fig. 1).

The identification of freshwater snails has caused naturalist and field ecologists a great deal of trouble and confusion because the external appearance of the animal and shell can be so variable, even within a single species. Boray and McMichael (1961) showed that in lymnaeids environmental factors, such as variations in water quality, can affect changes in the phenotypic appearance of the shell. A particularly difficult problem is the differentiation of the various groups of sinistral or left-hand coiled, high-spired freshwater snails. The identification to species level of these forms will have to await a comprehensive revision of these large complex groups. However the object of this paper is to provide a differentiation guide to the four genera in two families that are likely to be encountered in south-eastern Australia. These are (Fig.2.):—

Family Planorbidae
- genus *Physastra*
- genus *Isidorella*
- genus *Glyptophysa*

Family Physidae
- genus *Physa*

Fig. 1. Direction of coiling (a) sinistral or left-hand coiling and (b) dextral or right-hand coiling.



* Division of Zoology, National Museum of Victoria.

The characters used in the differentiation of these four genera are shell and external body characters, gross structure of the penial complex and gross form of the radula. The details of the various characters in these genera are given in Table 1.

SHELL. Tip of the spire can either be rounded or coming to a sharp point. In some the spire is high, whilst in others it can be very short to almost lost in the body whorl.

The columella may have a twist or be simple. This is an unreliable character and can be difficult to see in many specimens.

The shell may bear a series of periostracal hairs. These are usually arranged in rows around the body whorl. In some forms these can be so pronounced that the lines of hairs can be produced as carinations or ridges on the shell. In extreme forms, such as in *Glyptophysa*, the shell bears pronounc-

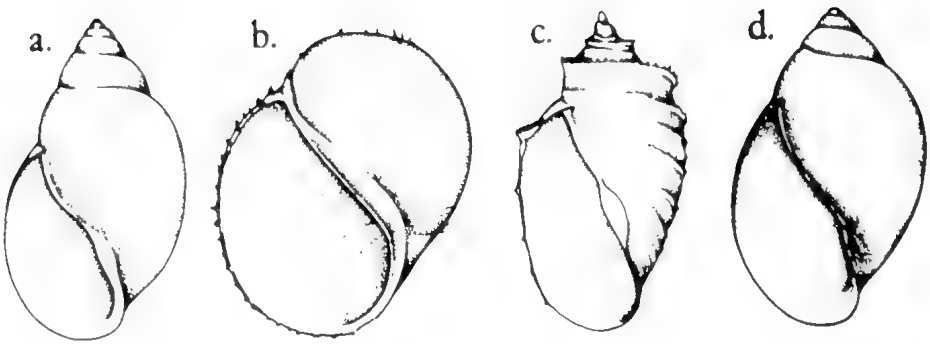


Fig. 2. Shells of (a) *Physastra*, (b) *Isidorella*, (c) *Glytophysa*, (d) *Physa*.

Table 1

Characters used in differentiation of sinistral freshwater snails.

Character	*Physastra*	*Isidorella*	*Glyptophysa*	*Physa*
Spire	rounded	rounded	sharply pointed	rounded
Columella twist	present	absent	present	present
Periostracal hairs	rare to absent	usually present	present	absent
Body colour	reddish	reddish	grey	pale
Pseudobranch	present	present	present	absent
Digital processes	absent	absent	absent	present
Flagellum on penis	present	absent	present	absent
Radula	entire	entire	entire	bifid

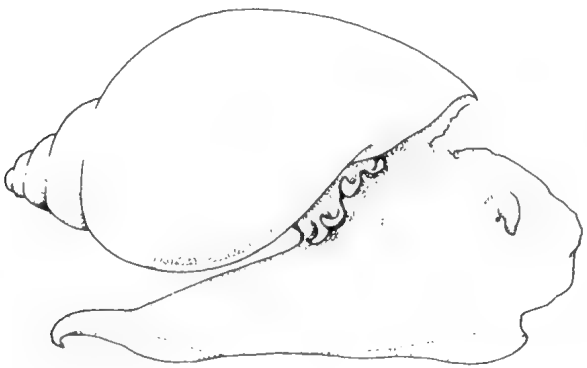


Fig. 3. Lateral view of *Physa* animal showing digital processes on the mantle.

ed carinations or ridges around the body whorl.

BODY. The general body colour can vary from red to heavily pigmented to very pale. The red colour denotes the presence of a pigment similar to haemoglobin.

The three planorbid genera posses a pseudobranch on the left hand side of the mantle cavity. This is not a very obvious character, particularly in a preserved specimen.

The genus *Physa* has a series of prominent digital processes on the mantle edge along the columellar margin (Fig. 3). These are particularly obvious in the crawling animal, but can be readily seen in the relaxed, preserved specimen.

PENIAL COMPLEX. The penis carries a flagellum in *Physastra* and *Glyptophysa*. This is a large blind-ending finger-like process arising from the inner end of the penial complex close to the point where the vas deferens enters the penis. The penial complex is situated immediately behind the left tentacle. It is easily dissected out from a relaxed preserved speciment using a stereo-binocular microscope (Fig. 4).

RADULA. The gross shape of the radula ribbon is different in the families Planorbidae and Physidae. In the Planorbidae the radula ribbon is entire, being a simple rectangle in shape. In the Physidae the radula is bifid in shape at the posterior end (Fig. 5).

The technique for extracting the radula is as follows:

1. Cut off the head-foot region or dissect out the buccal mass.
2. Boil in 10 per cent solution of caustic soda (sodium hydroxide) in a test tube until the tissues disintegrate on shaking.
3. Pour into small dish of water and search for radula (small transparent structure — shines under oblique light).
4. Transfer to water drop in microscope slide with mounted needle. Arrange, cover and observe on dark field.

The genera can be keyed out as follows:—

1. Digital processes on the mantle edge and bifid radula with oblique rows of teeth — Family Physidae, genus *Physa*.

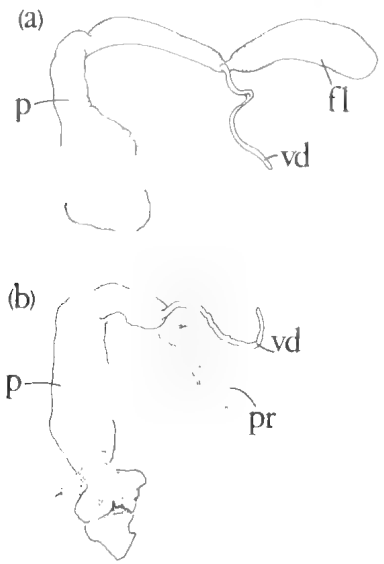


Fig. 4. Penial complex of (a) *Physastra* showing flagellum and (b) *Isidorella* without flagellum. (p - penis; pr — penial retractor; fl — flagellum; vd — vas deferens).

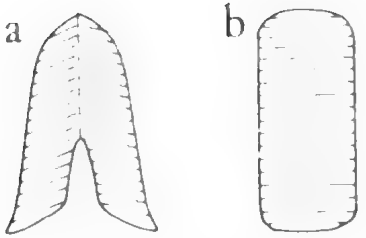


Fig. 5. Diagram showing (a) physid radula — bifid, (b) planorbid radula — entire.

1. Mantle edge entire, without digital processes; radula simple with transverse rows of teeth — Family Planorbidae. 2
2. Shell with sharply pointed spire, usually with pronounced carinations — genus *Glyptophysa*.
2. Shell with rounded spire, rarely with carinations. 3
3. Shell with columellar twist, periostracal hairs rare or usually absent, penis with pronounced flagellum — genus *Physastra*.
3. Shell without columellar twist, usually with periostracal hairs, penis without flagellum — genus *Isidorella*.

Work is currently in progress to amass collections and distributional data of these groups preparatory to undertaking taxonomic revisionary work on the group. The species currently recognised, with their habitat and distributional data for south-eastern Australia are listed below.

Many more species names exist in the literature for all these species. The ones currently in use represent a conservative assessment of the genera. Further species probably exist but much more reference material is needed before the extent of the fauna can be gauged.

Notes On Species

Physastra gibbosa (Gould, 1847)

Variable species, probably a complex of species, found throughout south-eastern Australia in freshwater rivers and lakes on weed and algae.

Isidorella newcombi (Adams and Angas, 1864)

A large, bulbous species found in the drier areas of northern Victoria and southern N.S.W. and South Australia in billabongs and creeks.

Isidorella hainesii (Tryon, 1866)

Usually a smaller species with a higher spire found in freshwater habitats that do not regularly dry out. Though previously thought to be found throughout south-eastern Australia, recent work has cast a doubt as to whether it occurs in Tasmania (J. Walker — pers. comm.).

Glyptophysa aliciae (Reeve, 1862)

Medium sized shell with strong spiral ridges in rivers and creeks of northern Victoria and southern N.S.W.

Glytophysa cosmeta (Iredale, 1943)

Small species with large aperture and body whorl and low spire, found in northern Victoria and southern N.S.W. This species was reported aestivating out of water as a method of surviving dry periods (Smith and Burn, 1976).

Physa acuta Draparnaud, 1805.

This is thought to be an introduced species, probably from Europe. Found in freshwater rivers and ponds in many parts of mainland south-eastern Australia. As research and collection assessment progress this appears to be a widespread and common species.

Acknowledgements

We would like to thank Mr John Walker from the University of Sydney for information and discussions on which this paper is based. Thanks are due to Mrs Lyn Anderson for typing the manuscript.

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The Victorian Field Naturalists Clubs Association

Excursion Report

Springtime Get-together at Alexandra (19-20 Sept., 1981)

The Upper Goulburn Field Naturalists Club, led by their President, Peg. LADE, was host to the Victorian Field Naturalists Clubs Association (President — Alan MONGER, Benalla) at their Springtime Get-together held on September 19th and 20th at Alexandra.

The Upper Goulburn Club has been in existence three years only, yet the organization of the meeting was efficient, interesting, and thoroughly enjoyed by the approximately seventy people who attended.

There was Representatives from the Field Naturalists Clubs of Benalla, Bendigo, Castlemaine, Creswick, Ringwood, and Melbourne, and a visitor from N.S.W.

At 1.00 pm. on Saturday, 19th, Mike CUSACK (Ranger), and Leon COSTERMANS led an excursion to the Cathedral State Park. The bridge over one of the tributaries of the Acheron River had been washed away during the recent floods, so that it was necessary to take the longer route through Buxton, and leaving the bus, to travel in by private car and Land Rover etc. to the saddle between The Sugarloaf and the foothills of the Blue Range.

After dinner, a meeting was held in the Alexandra High School, where slides were shown by Mr Warren GERMAN (Ranger and Founder Member of the Upper Goulburn F.N.C.), and by Mr Roy SPEECHLEY (Crown Lands Ranger), and Mr Leon Costermans.

There were displays of Aboriginal artifacts collected at Highlands by Mr Neil LADE, including some fine stone axes, pestle and grinding stones and some axe blanks; also some fine fossils and interesting photos from the area, were on display. About sixty-three persons were present.

On Sunday, 20th Sept., the Ranger, Mr Roy Speechley, led a party of about fifty persons through the McKenzie Flora Reserve, which is about one-hundred acres of bushland close to the Alexandra township, and a fine asset to the townspeople, and a tourist attraction.

The visiting botanists were asked to assist the host club by keeping lists of flowers and birds — forty-five species of flowering plants were seen, including a spectacular clump of white Hardenbergia; and thirty-five species of birds, of which the King Parrots, Olive-backed Oriole, and Rufous Whistlers, seemed to be the most popular sightings.

The weather was delightful — early Spring sunshine, with little wind — so that bird songs were accentuated and clear.

After lunch, the bus party from Melbourne visited the wild, timbered four-hundred acres of the Yarck Flora Reserve, where the Ranger asked visitors to look out for koalas, but none were seen . . . and so, reluctantly back to Melbourne about 5.30 pm.

Elizabeth K. Turner
Sec.-Treas. VFNC ASSN
Royal Children's Hosp., 3052.

New Books

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"Native Trees and Shrubs of South-Eastern Australia"

BY LEON COSTERMANS

Rigby Ltd., 1981. 26 x 19 cm,
428 pp., 318 col. & 176 B&W plates
ISBN 0-7270-1403-X
Price (discount to members) $29.95

Most regional accounts of woody plants are deficient in various ways: they either fail to be comprehensive, lack diagnostic detail or are too inadequately illustrated to be of much use in the field. Such criticisms can certainly not be levelled at the present book about indigenous trees and shrubs of south-eastern Australia, which is a paragon in every sense. No previous botanical work on a large sector of the continent has brought together *so* much useful information in more attractive or palatable form.

As delimited, "South-Eastern Australia" includes the whole of Victoria, New South Wales to a little north of Sydney and westward from the Warrumbungle Ranges to the South Australian border near Broken Hill, and South Australia east of Eyre Peninsula (including Kangaroo Island and more southern parts of the Flinders Range) — all told, an area nearly three times that of the British Isles. A teacher of science, Mr Leon Costermans has travelled widely within this vast region; his copious high-quality photographs are representative of the plant communities and species occurring throughout, from sea-level to alpine tracts and inland to the semi-arid zone. Tasmania was deliberately excluded while a wedge-shaped area of coastal to tableland country, fanning out northward from Nowra, has not been fully treated; its many rain-forest species lie beyond the scope of this book.

Virtually all trees of the region are described and illustrated, also the great majority of shrubs normally more than one metre tall — smaller undershrubs and climbers being omitted. Thus about 900 species are covered, including special sections on the wattles (130 spp.) and the eucalypts (120 spp.) for each species of which there are drawings of their fruits — an invaluable feature for identifications. The total number of illustrations is impressive: 318 colour plates, 176 black-and-white photographs, 720 line drawings accompanied by distribution maps, 83 other maps and explanatory diagrams — all by the author, and, as he lives in Melbourne, it is not surprising that most photographs were taken in Victoria.

This volume is designed to satisfy both scientist and layman, and its general plan is superbly conceived. The first section on "Aims, scope, and presentation" devotes four pages to explanatory detail. Next comes a 17-page account of "The land and its vegetation" — an outline of geology, climate, soils and ecological principles, with simplified geological map extending over pages 16 and 17. In section 3 attention is focussed on eight "Places of special interest", both scenically and floristically; this selection includes the Far South-east Corner (contained between Bega, Cape Howe, Cape Conran, the Cobberas and Southern Tablelands of N.S.W.), Pigeon House area near Ulladulla (N.S.W.), Mount Buffalo, the High Country, Wilsons Promontory, the Grampians, Wyperfeld National Park, and Flinders Range (S.A.), each with colour plates typifying the land forms and constituent vegetation. Section 4 sets out guide-lists of conspicuous species for eight major regions (e.g. coast, semi-arid inland, taller forests in moist valleys), a particularly instructive feature with line drawings for every species mentioned. Thus, if one encountered in the Little Desert dense thickets of a broomy bush with needle-like leaves and little knobs of tiny woody capsules, he would turn to the region F (on page 109) where an unmistakable drawing identifies the species as *Melaleuca uncinata* and refers one to page 248 for an ample description with map for this plant.

So we come to section 5 (pp. 141-379), the largest and most important part of the book — "Description of species". Set out systematically here, according to the familiar Englerian classification, is the descriptive detail with accompanying very lucid illustrations and inset distribution maps for all trees and shrubs treated. It is indeed stimulating, and a sheer delight, to pore over this galaxy of excellent pictures, whether in colour, half-tone, or black-and-white drawings. An

astonishing clarity is attained in the portrayal of 25 species of *Pomaderris* (pp. 216-221) — almost an illustrated monograph on this most difficult genus; each drawing incorporates a circular hand-lens magnification of the surface vestiture underneath a leaf — so important diagnostically —, as is also done with bipinnate *Acacia* species on pages 298-301.

The last section 6 gives interesting comments on the major plant families and genera involved. It is followed by a glossary (with some illustrations) of botanical terms, a list of abbreviations, and full indices to both scientific and vernacular names. Meticulous proof-reading is apparent throughout the whole text, wherein this reviewer has failed to detect a single typographical error. High praise is also due to the publishers, Rigby Ltd., and printers for a magnificent effort in which choice of paper and typography, layout and good pictorial reproduction leave little to be desired.

In recommending *Native Trees and Shrubs of South-Eastern Australia* with much enthusiasm, one almost runs out of superlatives but fully endorses the final paragraph on its dust-jacket: "The wealth of systematically organised information, combined with attractive illustration, makes this book an indispensable aid to any field observer — naturalist, student, or simply interested traveller — who wishes to develop an understanding and appreciation of this part of the Australian continent".

— J. H. Willis

Tasmanian Caddis-flies

BY ARTURS NEBOISS

Fauna of Tasmania Handbook No. 4, University of Tasmania, 1981, 180 pages. Price Aust. $5.75 (Aust. $6.75 by post). Available from: *Fauna of Tasmania* Office, University of Tasmania, Box 252C G.P.O., Hobart, Tasmania, Australia 7001. Payment should be made in Australian dollars. Cheques, money orders (free of charges) to be made payable to "University of Tasmania".

One of the more significant studies of the Australian fauna to appear in recent years has been "A Taxonomic and Zoogeographic Study of Tasmanian Caddis-flies (Insecta: Trichoptera)" (Neboiss, 1977, Mem. Nat. Mus. Victoria, vol. 38, 208 pp, 3 pls.). This new handbook is largely a condensed version of that earlier work written with a format more suitable for rapid identification of specimens. This comprehensive treatment of the Tasmanian caddis-fly fauna was made possible as a result of 7 extensive collection expeditions by Dr Neboiss and colleagues between 1965 and 1974 which gathered for detailed study about 1600 specimens, approximately 100 times as many Tasmanian Trichoptera as had ever been examined before now. The importance of the parent volume, and thus of this work, may be appreciated when one realizes (1) that 40% of the included species and 24% of the genera are described as new to science, (2) that 74% of the species are reported as endemic to Tasmania, and (3) that, from the total number of species recorded from each of 7 identified biogeographic provinces, the highest proportion of Tasmanian endemics are found in the western third of the island: Neboiss' northwestern and southwestern provinces (73% in each). The latter province is presently the subject of considerable controversy over potential habitat destruction by the Tasmanian hydroelectric scheme. Indeed, Dr Neboiss' maps reveal that 63% of the Tasmanian caddis-fly species are represented in the affected lower Gordon River area. Thus this handbook, along with *Fauna of Tasmania* Handbook No. 1 *(Tasmanian Odonata*, 2nd edition, 1981, by P. Allbrook), should provide timely assistance in assessing the immediate biological implications of the contemplated engineering works.

The introduction is a valuable overview of the order, including diagnostic notes with reference to their nearest relatives (the Lepidoptera), a review of their usual freshwater habitats, habits, and life history, and a summary of the main features of the Tasmanian fauna. The accompanying simplified phylogenetic diagram may help the reader understand Dr Neboiss' discussion of the historical relationships inferred by Ross for the different caddis-fly groups (Fig. 1).

Following the introduction, a checklist provides a classification of the 163 known Tasmanian species in 66 genera representing 21 numbered families. Concerning methods for examination of specimens, it should be mentioned that smaller specimens especially may need to have their wings cleaned of hairs and mounted on a microscope slide to permit study of diagnostic venation. A specimen's abdomen must sometimes be cleared of soft internal tissues or external debris in dilute KOH to allow examination of genitalic structures.

The keys are mostly new and untried, inviting users who may encounter difficulties to assist in their improvement and the attendant advancement of our science. There is a generous number of figures accompanying the keys, and the distribution maps are up-to-date.

In sum this handbook and the original research upon which it is based truly represent a major landmark in our comprehension of the Tasmanian caddis-flies. As such, it is an essential desk volume for freshwater naturalists and ecologists in Tasmania and will be utilized by them to considerable advantage for many years to come. Highly recommended!

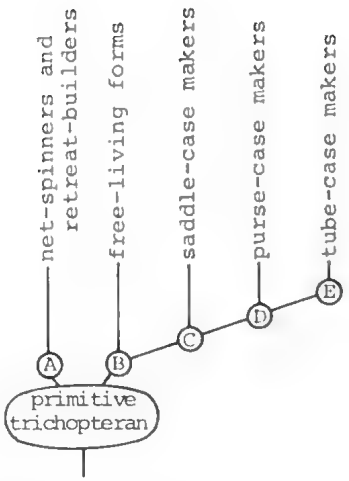

Fig. 1. Evolution of the larval case-making behaviour patterns of Trichoptera (Modified from the scheme of Ross, 1956)

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Some Strange Native Orchids

BY NOEL W. GILLAM*

Hunting for native orchids in areas near to Melbourne — say up to 150 km on the north to west sides — I occasionally find flowers which are different in structure to the standard description. For these, I use the term 'Oddities' and include several types — those described as rare, such as two flowers in the one bract for *Chiloglottis gunnii*, those where segments are joined together, or the flower has extra parts, or less than the normal number of parts (not including those broken or eaten off).

Considered as the most unusual structure, was a single flower of *Dipodium punctatum* growing in the centre of a long inflorescence of normal flowers, which was counted to score — 7 sepals, 5 petals, 3 labella, and 2 supplementary 'petal-like' segments attached to the column, which had a very wide stigma slot, and four, apparently normal, functional pollen caps. Orchids are supposed to have six parts plus the column, — this had 17 and a quadruplicated column, while the remaining 40 or more siblings were all normal.

At slightly simpler levels, have you ever seen — *Eriochilus cucullatus*, with two pollen caps above a single, slightly wider, stigma slot ? Twin flowers on *Spiculae huntiana* where the stem is single up to the third bract, and then divides into two separate, side by side, flowering stems? A double set of pollinia for *Diuris sulphurea* with four pollen tips showing above the stigma face and single viscidium, which showed on examination that the two outside pollinia were separate, but the middle two were bridged across as 'Siamese twins' pollinia? *Caladenia caerulea* with 5 rows of calli on the labellum, and two pollen caps on the single winged column? *Caladenia carnea* with all parts normal in

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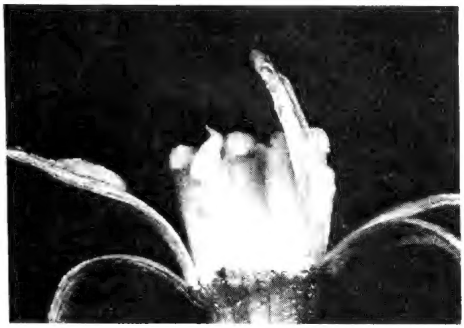

Fig. 1. *Dipodium punctatum*, the quadruplicated column of the 17 segment flower.

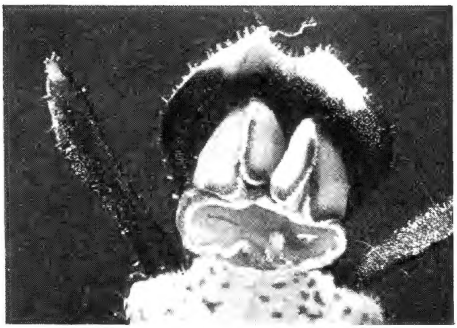

Fig. 2. *Eriorchilus cucullatus*, the two separate pollen caps on one stigma.

structure, but having 3 labella, one in the normal place, and the other two, slightly smaller in size, side by side on top of the first? *Caladenia dilatata* with 2 flowers from 2 bracts together on the stem, in contrast to 2 flowers (considered itself a rarity) from 2 bracts at different levels on the stem?

With a combination of considerable time, persistence, good eyesight and controlled responses, I now have observed 91 different native orchid 'oddities' (and 32 duplicates) covering 12 genera and 19 species, always marking the list with the words — 'to be continued'. This does not include albino orchids for 7 species, and a strange looking *Caladenia carnea* with striped petals (No, the one shown in Nicholls 'Orchids of Australia' has striped sepals).

On a provocative note, I conclude with two new laws — 'Botany belongs to the bush', and, 'Mother Nature does not read botany books'.

Australian Natural History Medallion Fund

Amount on hand July 1981	$1613.50
The Malacological Society of Australia. Vic. Branch	10.00
Miss I. Philips	20.00
Total amount October 1981	$1643.50

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Field Naturalists Club of Victoria

Reports of recent activities

General Meeting
Monday 12 October

Honorary Membership was awarded to Miss Ruth Clark of Bairnsdale who came to Melbourne to receive it. It's great when a country member arrives at our meeting to mark 40 years in this Club. Honorary membership was also awarded in absentia to Mr H. V. Milne and Mr C. A. Sonsee.

Gippsland Forests. Dr Smith spoke of the Scott report "Environment Effects Statement on Pulpwood Harvesting from State Forests in East Gippsland" published for the Forestry Commission. The report has many inadequacies and the terms of reference are not wide enough. There followed questions and discussion. Submissions to the Minister of Conservation were required by 9th October and a copy of our 16 page submission was tabled for members to examine.

Exhibits were few but two marine animals under microscopes were very interesting. A rust-coloured skeleton shrimp *Caprella* species, about 8 mm long and very slim, was resting on coralline seaweed; now and again some tiny circular transparent creatures could be seen about the shrimp's mouth, for this was a female and she has a brood pouch from which the young emerge and cling to the mother. Under another microscope some *Galeolaria* were waving their feeding tentacles.

General Meeting
Monday 9 November

The meeting did not start until 8.20.

New Medallion. Because the die of the Natural History Medallion is worn out, because the old method of reproduction is increasingly costly, and because many members are not happy about the old design, Council had decided to commission a new design for reproduction by a less costly method. The job was given to Mr Matchem Skipper. His final design shows a small lizard in a rocky terrain, the whole bronze piece being about 7 cm long (2¾") and mounted on a polished opal slab about 15 cm x 10 cm (6" x 4"). It could be used as a paper-weight or desk ornament.

1981 Medallionist. This year the Natural History Medallion was awarded to Dr Elizabeth Marks of Queensland. When making the presentation, Dr Churchill spoke of Dr Marks' notable work on Australian mosquitoes and her contribution to natural history generally. As well as her many papers on mosquitoes, Dr Marks has published biographies of several biologists and historiea of sundry societies. She is a member of 15 societies and has ticked up 44 years in the Queensland Field Naturalists Club; during that time Dr Marks was editor for many years of the Club's journal "The Queensland Naturalist" and President several times.

Natural History of Mosquitoes was the subject of the speaker Dr Elizabeth Marks. Dr Marks said that we probably disliked mosquitoes but she hoped to make us realise that they are also very fascinating. There are 260 species in Australia, of which 74 occur in Victoria; there are only three introduced species.

Dr Marks showed diagrams of various egg shapes and said they might be laid singly or in rafts; most mosquito eggs float, some sink to the bottom, and a few are not laid on water but on damp vegetation and drop to the water when they hatch. The larvae also vary but the comma-shaped pupa is fairly typical of all. Dr Marks then talked of some of the more important mosquito genera in Australia. One species breeds in the water of the North Queensland pitcher plant. The plant digests the insects in its pitcher but the mosquitoes evade that fate; nobody knows how.

(Continued from page 226)

GROUP MEETINGS

FNCV members are invited to attend any Group meeting, no extra charge.

Day Group — Third Thursday.

January. No meeting.

Thursday, 18 February. Alexandra Gardens. Meet at Princes Bridge on the south side of the river at 11.30 a.m. Leader: D. McInnes (211 2427).

Thursday, 18 March. Port Authority harbour cruise. Booking is necessary through the leader, D. Gillespie (578 1879).

At the National Herbarium, the Domain, at 8.00 p.m.

First Tuesday — Mammal Survey Group.

January — no meeting.

Tuesday, 2 February, Longfooted pottooroo. Speaker: John Seebeck.

Third Wednesday — Microscopy Group.

Wednesday, 20 January. Members exhibit night.

Wednesday, 17 February. Memories of the Microscopical Society of Victoria. Speaker: Mr Des. Wentworth.

Second Thursday — Botany Group.

Thursday, 11 February. A naturalist in Western Australia. Speaker: Mrs Ilma Dunn.

Thursday, 11 March. Mistletoes and mistletoe mythology. Speaker: Dr Malcolm Calder, University of Melbourne.

At the conference room, the Museum, at 8.00 p.m. Good parking — enter from Latrobe St.

First Monday — Marine Biology and Entomology Group.

January — no meeting.

Monday, 1 February. Specimens and observations by members — insect or marine.

GROUP EXCURSIONS

All FNCV members are invited to attend group excursions

Mammal Survey Group

January — Australia Day weekend. Saturday to Monday. Howqua.

Saturday, 13 — Sunday, 14 February. Enterprise Plateau, Eildon.

Saturday, 6 — Monday, 8 March. Mt Alexander.

(Continued from page 266)

Exhibits. Silky Hakea *H. sericea* had grown to about 6 metres (20ft) and died; its owner showed a cross section of the trunk, diameter 6-8cm (2½-3″), very pale in colour with distinct dark concentric lines at varying intervals; the tree was 15-17 years old. A small, biscuit-colour, woolly caterpillar, a bit longer than a centimetre (up to ½″) had made a definite bite like an ant bite that caused a rash and weals.

Under a microscope was a mosquito head showing the biting parts and, under low power, were four different species. Several pieces of rock carried the question "fossil wood or not?" Sections under microscopes helped some people to find the right answers.

Nature Notes. A stock insect about 15 cm long (6″) was found in a Balwyn garden. Little Grebes are breeding in stock tanks in the Robinvale area. A plucky Plover refused to leave her nest although within touching distance of the observer.

Field Naturalists Club of Victoria

Established 1880

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 Honorable SIR HENRY WINNEKE, KCMG, KCVO, OBE, KStJ, QC.

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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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