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Front cover: Eastern Grey Kangaroo *Macropus giganteus*. See p. 172. Photo by Dan Carey Photography.
Back cover: Pink Heath *Epacris impressa*. Photo by Dan Carey Photography.

A good time for a fire? A note on some effects of wildfire on a Grassy White Box Woodland

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Abstract
A remnant stand of Grassy White Box Woodland, containing trees that had been monitored for abundance of reproductive structures since 2000, was burnt by wildfire in late 2006. Very little seed was present in the aerial seedbank of White Box at the time of the fire and, due to the destruction of the newly-forming capsules, seed is likely to be in short supply in the near future. Seedling recruitment of White Box was minimal after the fire. However, the existing woodland structure is likely to be maintained as most of the fire-damaged trees regenerated vegetatively. Most of the other native perennials, woody and herbaceous, regenerated vegetatively, but exotics – mostly annuals – increased markedly via seedling recruitment during the year following the fire. (*The Victorian Naturalist* **125** (6), 2008, 160-165)

Keywords: Grassy White Box Woodland, wildfire, reproductive structures, recovery, fire damage

Introduction

Grassy White Box *Eucalyptus albens*[1] Woodlands (Prober and Thiele 1993) extend from southern Queensland through New South Wales (NSW) to north-central Victoria. Scattered occurrences are also present in western Victoria, the Snowy River area and the southern Flinders Ranges of South Australia. It is listed nationally as an endangered ecological community under the *Environment Protection and Biodiversity Act 1999.* Stands with intact structure and groundstorey composition are rare (Prober 1996). Patchy fires may have played a role in maintaining these woodlands in their original state (Allcock *et al.* 1999). Most grassy (rather than shrubby) woodlands are located on relatively fertile soils (a primary reason for their demise since European settlement) where fires or other disturbances that remove accumulated biomass and create regeneration niches are necessary for maintaining groundstorey diversity (Lunt *et al.* 2007). Fire is often considered a prerequisite for eucalypt recruitment in humid forests due to its creation of a competition-free, nutrient-enriched seedbed and, via canopy scorch, synchronous fall of seed of sufficient quantity to satiate seed predators (Florence 1996).

Though fire can assist seedling recruitment of woodland eucalypts under certain conditions (e.g. Semple and Koen 2001), it is not necessary in subhumid environments where, for example, regeneration often occurs following the breaking of a drought (Curtis 1990), or suppressed seedlings are released following a run of seasons with above-average rainfall (Jacobs 1955).

A small stand of Grassy White Box Woodland, 6 km south-west of Molong in the Central Western region of NSW, extended across three land tenures: freehold, crown reserve ('Pinecliffe Reserve') and road reserve. Despite some past tree felling (Fig. 1a) and recent exotic tree planting (Fig. 2b) on the freehold, the stand was relatively intact, i.e. trees were at woodland spacings with mixed age-classes and the groundstorey contained many of the native perennial grasses and forbs that would be expected in this vegetation type. Exotic annuals were present but not dominant – a common occurrence in most remnants of White Box woodland in the southern portion of its range (Prober 1996). Wildfire swept through the stand in November 2006 and consumed virtually all of the above-ground herbage and much of the small woody material present (Figs. 1c and 2c). Canopies of many of the trees were consumed suggesting that 'crown fire conditions were experienced.

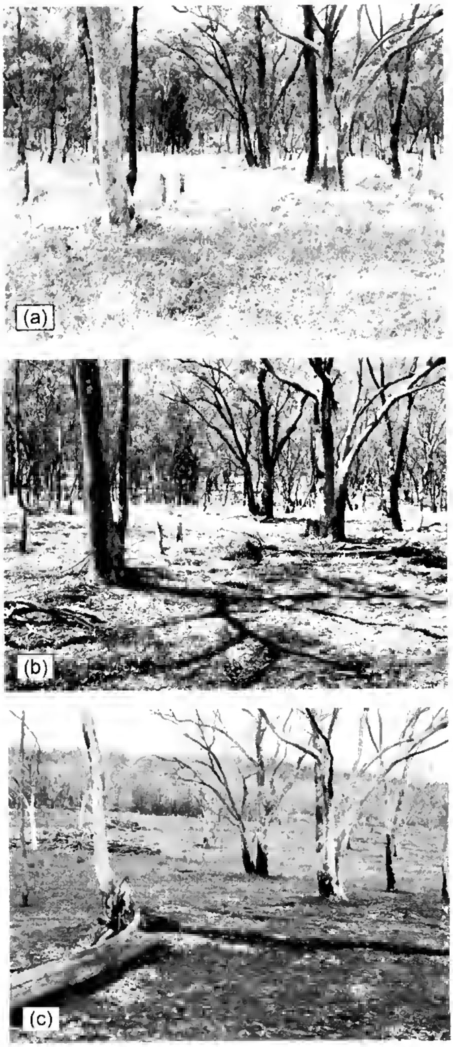

Fig. 1. Part of the grassy White Box community near Molong (NSW) as it appeared on the freehold area in (a) March 1994 [64/6]; (b) February 2003 during drought conditions [206/12]; (c) early April 2007 four months after the fire [252/18].

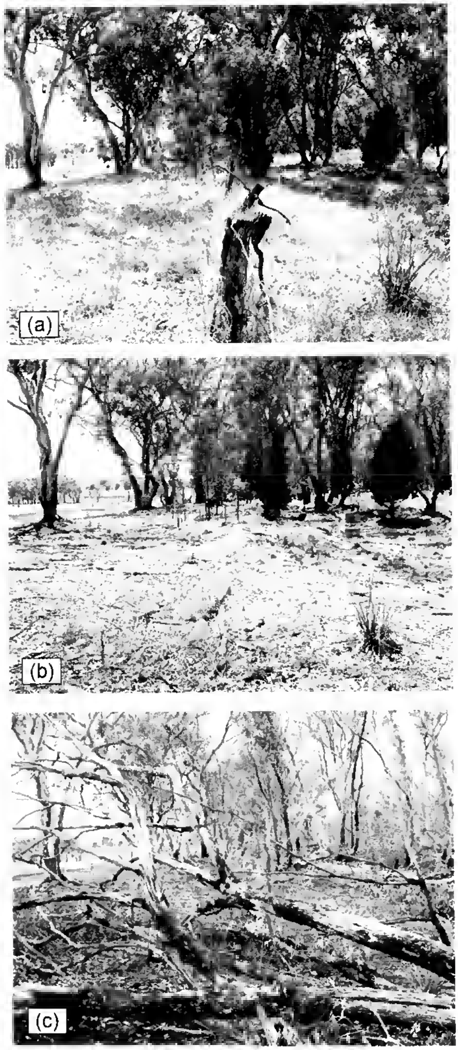

Fig. 2. Part of the monitored (road reserve, left hand side of the fence) and unmonitored stand of White Box as it appeared in (a) April 2000 [169A/25]; (b) February 2003 during refencing and following planting of exotics (protected by drums) in the adjacent freehold [206/11]; (c) early April 2007 four months after the fire. Note the absence of *Callitris endlicheri* to the right of the fenceline [252/20].

As part of a larger project (currently being prepared for publication), 13 White Box trees on a 15 x 150 m section of the roadside at Molong had been monitored for the seasonal abundance of reproductive structures from March 2000 to November 2007. An abundant flowering in 2006, the first since 2001, was just replenishing the declining aerial seedbank with immature capsules when the fire occurred. As seed from more than one flowering may be present in the canopy of White Box trees and seed may be held in capsules for up to 3 years (Semple *et al.* 2007), only seed from a minor flowering of 2004 was likely to have been present when the fire occurred. Seed in the newly-forming capsules was unlikely to have been viable as a period of at least 6 months after flowering is usually necessary for seed maturation in temperate eucalypts (Boland *et al.* 1980) and possibly longer for White Box (Burrows 1995).

Following the fire, opportunity was taken to continue monitoring the White Box trees and to document the recovery of other species in the stand.

Methods

The extent of fire damage (e.g. canopy scorch, basal burn) to each of the monitored White Box trees was noted. The abundance of reproductive structures (buds, flowers, capsules) was assessed with binoculars as previously, using a 6-point scale (0, nil, to 5, maximum possible; with 3 representing 'obvious and dispersed across most of the canopy'), at approximately 2-monthly intervals, from November 2006 until March 2008. Regenerative mechanisms of woody species were noted and in one case, a regenerative structure was excavated. Any seedlings of White Box were tagged. Recovery of herbaceous species was assessed qualitatively during the early part of the above activities.

Results

White Box

Three of the monitored roadside trees appeared unaffected by the fire, three suffered minor scorch (<30% of canopy affected) and the remainder had various levels of lower trunk damage and up to 100% canopy scorch. Immature capsules in scorched parts of White Box canopies ripened prematurely and took on a dull light brown colour unlike that of normal mature capsules. After the fire, most of the trees, even those that had experienced minimal canopy scorch, shed some of their crop of (immature and more mature) capsules but, as shown in Fig. 3, this was a normal occurrence following capsule formation.

Any mature capsules present would have shed seed shortly after the canopy was scorched or burnt but, as noted above, such capsules were few and little seed was probably shed. This was reflected in the low numbers of new seedlings found on the monitored part of the roadside: 12 (10 evident after a search in April 2007 followed by another two smaller ones later in the year) and all probably from the seed of one or two trees. Only one of the seedlings died during the summer of 2007/08. Apart from the few undamaged trees, mainly on the roadside, the potential seed crop from the 2006 flowering would have been destroyed.

New floral buds normally become evident in November/December but none was evident in 2006 – probably a consequence of the previous season's abundant flowering rather than of the fire *per se*. However,

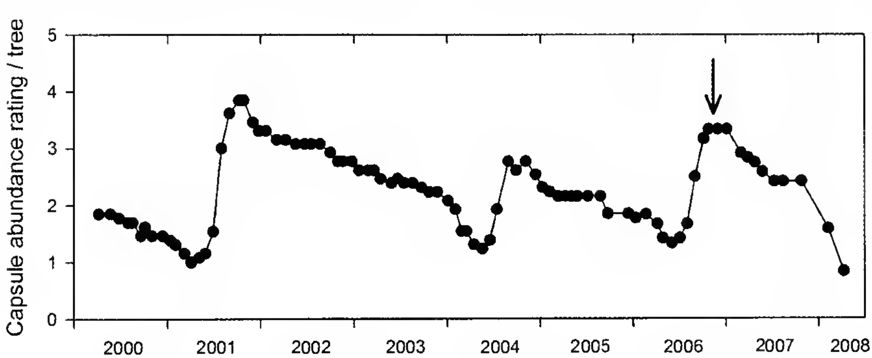

Fig. 3. Mean (n = 13 until January 2006 and 12 thereafter) capsule abundance rating (0–5, see text) in the monitored roadside stand of White Box from March 2000 to March 2008. Time of wildfire is indicated by arrow. Note that no distinction is made between capsules of different maturities. Most of the capsules present at the time of the fire were immature and after the fire about half of the capsules were dead (see text).

Table 1. Regenerating native species in a Grassy White Box Woodland in Central Western NSW, approximately 5 months after wildfire. Virtually all regeneration was vegetative – from stems and/or below-ground structures. * = Kurrajong regenerated from buds on stems (larger trees), basal buds (smaller trees) and from swollen roots (small trees, Fig. 4).

Trees and shrubs	
Hickory Wattle *Acacia implexa*	Hill Red Gum *Eucalyptus dealbata*
Kurrajong *Brachychiton populneus**	Grey Guinea Flower *Hibbertia obtusifolia*
White Box *Eucalyptus albens*	
Herbaceous monocotyledons and ferns	
Rock Fern *Cheilanthes* sp.	Pinrush *Juncus* sp.
Purple Wiregrass *Aristida ramosa*	Wattle Mat-rush *Lomandra filiformis*
Wallaby Grasses *Austrodanthonia* spp.	Smooth Flax Lily *Dianella longifolia*
Redgrass *Bothriochloa ?macra*	Black-anthered Flax Lily *Dianella revoluta*
Barbed-wire Grass *Cymbopogon refractus*	Chocolate Lily *Arthropodium* sp.
Cotton Panic *Digitaria brownii*	Bulbine Lily *Bulbine bulbosa*
Silky Browntop *Eulalia aurea*	Yellow Rush Lily *Tricoryne elatior*
Microlaena *Microlaena stipoides*	
Herbaceous dicotyledons	
Sheep's Burr *Acaena* sp.	Climbing Saltbush *Einadia* sp.
Joyweed *Alternanthera* sp.	Stinking Pennywort *Hydrocotyle laxiflora*
Common Woodruff *Asperula conferta*	Variable Plantain *Plantago varia*
Yellow Burr-daisy *Calotis lappulacea*	Solenogyne *Solenogyne* sp.
Tick Trefoil *Desmodium* sp.	New Holland Daisy *Vittadinia* sp.
Kidneyweed *Dichondra repens*	Bluebells *Wahlenbergia* spp.

three trees (two apparently undamaged and one with minor basal and foliage damage) produced some buds in March 2007 but these did not produce flowers until autumn 2008. [Bud production prior to November was unusual but had been recorded in a few trees in this stand previously and, as in this case, none produced flowers until the following year (Semple and Koen, unpubl. data).]

Surprisingly, none of the trees produced buds at the normal time in the following season (i.e. November/December 2007) but as before, some trees (four with the likelihood of another two – none of which was severely affected by the fire) produced some buds in autumn 2008 – though on previous experience, these will yield only a few flowers in 2009. Whether or not this apparent shift in bud production from late in the year to early in the year was due to the fire (or high temperatures associated with it), or to other factors such as prevailing dry conditions or the ongoing increase in average temperatures ('global warming'), is unknown. In any case, the aerial seedbank is unlikely to be partially replenished until 2009 at the earliest.

None of the monitored trees was killed by the fire and this probably also applied to those in the unmonitored areas. Small trees regenerated from lignotubers or basal epicormic shoots as did those trees whose trunks were destroyed. Less severely damaged trees regenerated from epicormic buds.

Other woody species

Apart from Black Cypress Pine *Callitris endlicheri* (compare Figs. 2a and 2c) and a Ballart *Exocarpos* sp., none of the woody plants in or near the monitored area appeared to have been killed by the fire. Some possible seedlings of Kurrajong *Brachychiton populneus* and Hickory Wattle *Acacia implexa* were present, but most native species regenerated vegetatively (Table 1, Fig. 4).

Herbaceous species

Much of the early regeneration was vegetative (Table 1). Storms in the summer of 2006/07 promoted limited germination of mainly exotic species but, by mid April 2007, vegetative cover was very low (Fig. 1c) – a probable consequence of the patchy distribution of native perennials. Late autumn rains in 2007 resulted in further germinations, mainly of exotics (particularly *Anagallis, Avena, Lolium, Trifolium* spp.) and groundcover increased considerably. When last visited in March 2008,

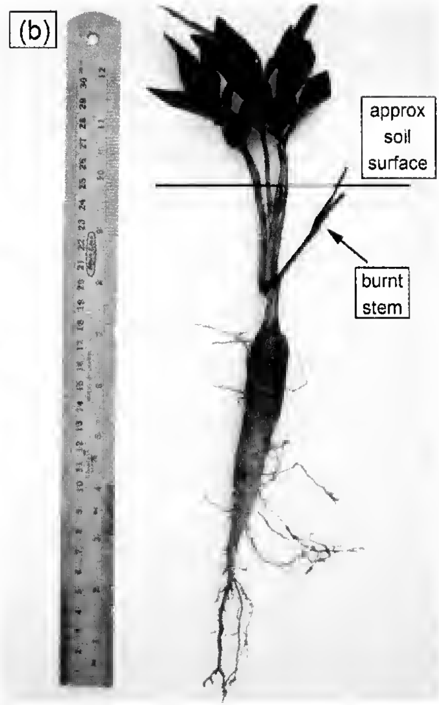

Fig. 4. Small Kurrajong that produced multiple stems from a swollen root after the original stem had been burnt 10 months previously: (a) prior to excavation [262/25] and (b) after excavation [263/17].

Feather-top Rhodes Grass *Chloris ventricosa*, an exotic perennial encroacher from the immediate roadside, was present over much of the monitored area – a probable consequence of rainfall in November/ December 2007.

Discussion and Conclusions

Despite the death of localised Black Cypress Pine and Ballart (which will probably regenerate from seed at some future time and still exist in unburnt patches), it was unlikely that any species, woody or herbaceous, was lost from the stand as a result of the fire. None of the roadside eucalypts, White Box and Hill Red Gum *Eucalyptus dealbata*, was killed and despite the stacking of fallen trees in part of the burnt area (Fig. 1c), this would probably be the case in the adjacent freehold. Assuming that lignotuberous (not fully evident in Fig. 1c) and other regeneration is allowed to survive as is required under NSW's *Native Vegetation Act 2003*, the structure of the woodland would eventually return to the pre-fire condition even without seedling regeneration.

However, if seed had been abundant in the canopy and the wildfire had promoted synchronous seed fall and massive seedling recruitment, a denser stand of trees, i.e. of forest structure, may have resulted. The occasional occurrence of stands of typically-woodland eucalypts with open forest structure elsewhere suggests that their origin may be due to past crown fires rather than to the 'patchy' and presumably less intense fires that Allcock *et al.* (1999) suggested were responsible for the maintenance of grassy woodlands.

A good time for a fire? From a conservation perspective: probably not, at least for a fire of the intensity that occurred. Due to the low abundance of mature seed in the canopy of White Box, the fire was not conducive to extensive seedling recruitment. Potential replenishment of the canopy seedbank was destroyed and is unlikely to be replaced for some years. Woodland structure will take many years to recover (though the numerous standing and fallen dead tree trunks may ultimately have some habitat benefits). Although many native herbaceous perennials regenerated vegetatively, albeit patchily, shortly after the fire, the large areas of bare ground were conducive to extensive seedling recruitment of exotic annuals following late autumn rains. This is likely to have an adverse effect on current and future seedling recruitment of native species.

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Note

[1] Botanical nomenclature follows that of Harden (1990-93).

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Water Rats as predators of Little Penguins

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Abstract

Water Rats are widely distributed throughout a variety of habitats and are known to be opportunistic predators. Their occupation in coastal areas often occurs within Little Penguin colonies, but interactions between the two species have not previously been reported. Given that Water Rats prey on other bird species, it is likely that they will also take young or weak Little Penguins. Here the case of a Little Penguin chick death that has been attributed to an attack by a Water Rat is reported. (*The Victorian Naturalist* **125** (6), 2008, 165-168).

Keywords: Water Rat, penguin, predation

Introduction

The native Water Rat *Hydromys chrysogaster* is an opportunistic predator, known to eat insects, crustaceans, fish, spiders, frogs, bats, shellfish, turtles, birds, carrion and some plant material (Woollard *et al.* 1978; Dickman *et al.* 2000). Widely distributed throughout Australia, Water Rats are considered common in large cities (Menkhorst and Knight 2001), occupying a variety of freshwater, estuarine and marine environments (Seebeck and Menkhorst 2000). Often inhabitants of coastal areas, the range of the Water Rat sometimes overlaps with that of sea-birds such as Silver Gulls *Larus novaehollandiae*, Short-tailed Shearwaters *Puffinus tenuirostris* and Little Penguins *Eudyptula minor* (Woollard *et al.* 1978; Wilson and Duffell 2005). Although Water Rats have previously been reported taking shearwaters, ducks, domestic fowl and a number of waterfowl (Woollard *et al.* 1978), there has been no report of them preying on Little Penguins.

Water Rats are known to live within the Little Penguin colonies at Phillip Island (P Dann, pers. comm.), Cat Island (Wilson and

Duffell 2005) and St Kilda (present study). The number of sites where the two species co-exist is probably much greater, given their overlapping distribution in south-eastern Australia. It has long been postulated that the Water Rats may take vulnerable penguin chicks and eggs, but until now no evidence to support this theory has existed. A case of predation on a Little Penguin chick by a Water Rat at the St Kilda breakwater is reported here.

Site Description

A small population of Water Rats lives on the artificially constructed breakwater wall at St Kilda (37°51'S, 144°57'E), 5 km from Melbourne. The breakwater wall is made up of large boulders and extends approximately 640 m from the end of the St Kilda pier. The population of Water Rats on the breakwater fluctuates, with up to nine individuals sighted in a night (unpubl. data). It is unknown whether the Water Rats breed on the breakwater wall, but juveniles have been seen in the area (pers. obs.). The Water Rats probably swim between the breakwater and shore, where they are commonly seen in a number of nearby drains and canals. Water Rats have been observed only within the sheltered harbour, as wave conditions around the outer wall of the breakwater make observations difficult.

The breakwater wall at St Kilda is also home to a colony of approximately 820 Little Penguins (ZM Hogg, unpubl. data). The Little Penguins have been nesting on the breakwater wall since at least 1974 (Eades 1975). Most of the penguin colony is fenced to prevent attacks by dogs and vandals. The only other vertebrates to reside on the breakwater are Silver Gulls and Little Ravens *Corvus mellori*, but their occupancy is sporadic. The breakwater is free from other native and introduced penguin predators.

Observations

During routine study of penguins in the 2007 breeding season, a Water Rat was observed on the breakwater near a penguin nest containing two post-guard chicks. Two penguins suspected of being the parents were observed returning from sea, but were not seen to approach the rat. The penguins and rat were not watched any further for fear of disturbing chick feeding. Upon return to the same nest two days later, one penguin chick was found dead inside the nest. The remaining chick showed no sign of injury and had put on weight since the previous visit. An adult penguin was also found in the nest, although the penguin chicks were originally left unguarded 15 days prior.

The downy chick weighed 840 g on the last day it was seen alive, its body recovered two days later weighed 620 g. The carcass was found extremely disfigured (Fig. 1); the head and neck had been attacked and eaten, and there were several holes in the back and around the left leg of the penguin. On initial recovery, the holes showed some signs of small teeth marks, but photographs were unable to show these as the skin quickly shrivelled with heat once the body was removed from the nest. Muscle and internal organs had been eaten through the holes in the back. Although damage to the chick was extensive, the body had not been completely stripped of flesh.

Post-guard chicks will often run to evade capture, but in this case the chick was found backed inside the nest. For the two weeks that the chick was left unguarded, it displayed both avoidance and defensive behaviour during regular weighing and handling. The amount of damage caused to the head (Fig. 2) indicates that the chick did try to defend itself by pecking whilst being attacked, but the bill of a penguin chick is too small to do any serious damage to a predator.

Water Rats are the only toothed animals observed on the breakwater (pers. obs.). The small teeth marks observed on the body, together with the sighting of a Water Rat in the immediate vicinity of the attack, lead to the conclusion that the chick was preyed on by a Water Rat.

Both Water Rats and Little Penguins have been studied at this colony, but until now predation by the rats on the penguins had not been observed. Penguins and Water Rats display very little interaction. The two species often swim past each other near the breakwater, as the penguins return from sea at dusk, which is also the time of peak foraging activity in the Water Rat (Olsen 1995). Neither penguins nor

Water Rats show any obvious signs of avoidance or defence upon encountering the other species in the water (pers. obs.). There have been very few sightings of penguin and Water Rat interaction on land, with penguins tending to be more timid and deliberately avoiding other animals once out of the water (pers. obs.).

Water Rats on the breakwater are suspected of taking penguin eggs when they disappear from nests or are found broken with the contents consumed. However, there is no direct evidence for this. It is likely that some eggs are taken by the ravens that occupy the breakwater periodically, or the penguins themselves may remove abandoned eggs from nests. Whether Water Rats take penguin eggs may also depend on whether the eggs are cracked, as observed by Woollard *et al.* (1978). Likewise, penguin chicks often disappear from their nests, but it is not known what has taken them or whether they have moved of their own accord, which often happens as the chicks become more mobile (Reilly and Cullen 1981).

Water Rats do not appear to kill a large number of penguin chicks, despite their being available for approximately seven months a year at St Kilda. Little Penguin chicks are vulnerable and approximately half die prior to fledging (Dann *et al.* 2000), but in 21 years of penguin study at this colony, this is the first reported instance of Water Rat predation on the penguins. Young penguin chicks are guarded by adults, which are unlikely to be attacked by Water Rats due to their vigorous defence. The main prey of the Water Rat at St Kilda appears to be marine invertebrates and crustaceans (A McCutcheon, pers. obs.), with penguin eggs and chicks probably an infrequent and opportunistic addition. Within penguin colonies it is likely that the Water Rats will feed on eggs and chicks occasionally, but a lack of evidence for these attacks suggests that they are not a significant predator of Little Penguins.

Fig. 1. Carcass of Little Penguin chick showing holes in its back where it was attacked by a Water Rat. Photo by Andrew McCutcheon.

Fig. 2. Front of penguin chick carcass showing extensive damage to the head. Photo by Andrew McCutcheon.

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Studies on Victorian bryophytes 9: the genus *Hymenodon* Hook.f. & Wilson

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Abstract

The moss genus *Hymenodon* Hook.f. & Wilson (Rhizogoniaceae) comprises eleven speeies but is represented in Victoria by a single speeies, *Hymenodon pilifer* Hook.f. & Wilson. Its main habitat is the trunks of tree-ferns and trees (rarely rock or clay banks) in cool temperate rainforest. Its conservation status appears to be 'secure' nationally and in Victoria and Tasmania, but is uncertain in New South Wales and Queensland. (*The Victorian Naturalist* **125** (6), 2008, 169-171)

Keywords: bryophyte, *Hymenodon*, liverwort, Rhizogoniaceae, Victoria

Introduction

The genus *Hymenodon* was erected by Joseph Hooker and Thomas Wilson to accommodate a plant first collected from New Zealand (Hooker and Wilson 1844). Eleven species are recognised at present, of which two occur in the Caribbean and tropical South America and eight in South East Asia and the tropical regions of the western Pacific. Only one species, *Hymenodon pilifer* Hook.f. & Wilson, is known from Australia. Karttunen and Back (1988) reduced *H. sericeus* (from South East Asia) and *H. tenellus* (a New Caledonian endemic) to subspecies of *H. pilifer*. However, few bryologists seem to have accepted this reduction, and the highly reputable TROPICOS database does not recognise the subspecies (MBG 2008). In this paper *H. pilifer* is considered distinct from *H. sericeus* and *H. tenellus*.

Description

Hymenodon pilifer Hook.f. & Wilson, *London J. Bot.* 3: 548 (1844)

Dioicous. **Female plants** very small, pale green, sometimes slightly glaucous, to about 15 mm long, projecting out and down from the substratum. Base of stem enveloped in a dense tuft of reddish-brown papillose rhizoids. **Leaves** arranged all round the stem, more or less oval with a narrow hair-like projection at the tip (hairpoint), lamina typically 0.4–0.9 × 0.2–0.35 mm, hairpoint 0.2–0.5 mm long; leaf margin plane, crenulate from projecting cell walls. **Costa** (midrib) distinct, pale, extending almost to the end of the lamina but not reaching into the hairpoint. **Cells** of the lamina mostly irregularly hexagonal (but walls difficult to discern), ± isodiametric, typically 12–15 μm wide and long in mid-leaf (smaller towards margins), very thick-walled, each cell containing one chloroplast (rarely two) that almost fills the lumen; hairpoint consisting of a single long, narrow cell.

Female branch very short, hidden among the rhizoids. **Bracts** reddish-brown, lanceo-

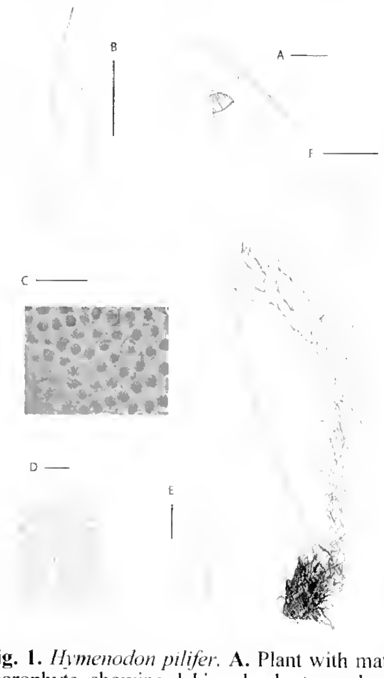

Fig. 1. *Hymenodon pilifer*. **A.** Plant with mature sporophyte, showing dehisced calyptra and operculum. **B.** Typical leaf. **C.** Cells in mid-leaf, showing large chloroplasts. **D** Exothecial cells. **E.** Female bract. **F.** Spore. (Scale bars: A = 1 mm, B,E = 0.2 mm, C,D = 100 μm; F = 20 μm.)

late with an acute apex, margins plane, entire to weakly crenulate in upper half, cells long-hexagonal to rectangular, thin-walled and empty, surface smooth, costa distinct, to about 2/3 of bract length. **Seta** up to 15 mm long. **Capsule** ± ovoid to almost cylindrical, vivid green when young, pale brown when mature, about 3 × 1 mm including operculum; exothecial cells thick-walled, very irregular in size and shape. **Operculum** conical with a long, slanting beak. **Calyptra** with a long beak widening to a paddle-shaped base, not enveloping the capsule. **Peristome** single (outer peristome lacking), comprising 16 long, narrow, incurved teeth with vertical and horizontal striations. **Spores** up to 20 μm in diameter, very pale brown when mature, surface minutely warty. **Male plants** reportedly dwarf (not seen) (Fig. 1).

Distribution and habitat

Hymenodon pilifer is known from New Zealand, Tasmania, Victoria, New South Wales and Queensland. Gilmore (2006) did not include Queensland in the distribution of the species because he had not seen a specimen from there. However, Ilma Stone published details of a specimen from Lamington National Park (Stone no. 4226), and that specimen is in MEL (duplicate in MELU) along with some other Queensland collections.

In Victoria *H. pilifer* occurs almost exclusively in wet sclerophyll forest and cool temperate rainforest at scattered localities from East Gippsland in the east to Byaduk Caves in the west (Fig. 2). It grows mainly on Soft Tree-ferns *Dicksonia antarctica* and Rough Tree-ferns *Cyathea australis*, although it is occasionally found on trees such as Myrtle Beech *Nothofagus cunninghamii*, Blackwood *Acacia melanoxylon* and Blanket-leaf *Bedfordia arborescens*, and rarely on rock or clay banks. The Byaduk Caves locality, where *H. pilifer* grows on basalt in deep shade, is the westernmost extent of its total range and is a notable exception to the typical habitat.

Most of the Victorian localities are in large conservation reserves, and the rainforest habitat is generally protected from threats such as wildfire and timber harvesting, so at the present time *H. pilifer* may be considered secure in Victoria. For the same reasons it is also secure in Tasmania, where it is very common. In New South Wales and Queensland it is known from very few localities, so its conservation status in those states is in doubt and should be formally assessed.

Because Byaduk Caves is the westernmost occurrence of *H. pilifer* and is extremely isolated from other localities, its status at that site needs urgent assessment.

Similar species

Several other mosses share the habitat of *H. pilifer* and can be easily confused with it in the field (Fig. 3). The most common confusion is with *Leptotheca gaudichaudii* Schwägr., which has the same delicate

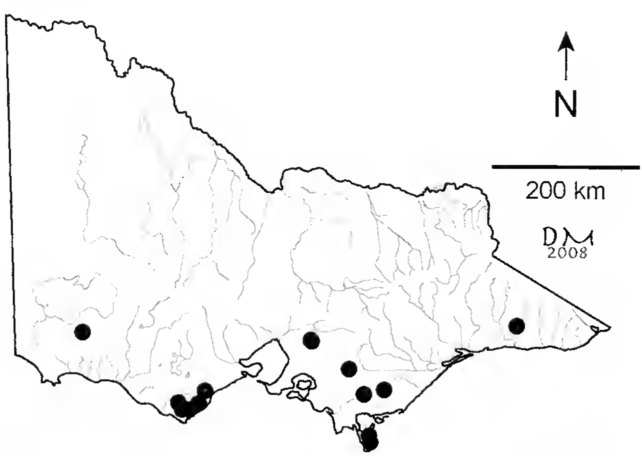

Fig. 2. Known distribution of *Hymenodon pilifer* in Victoria.

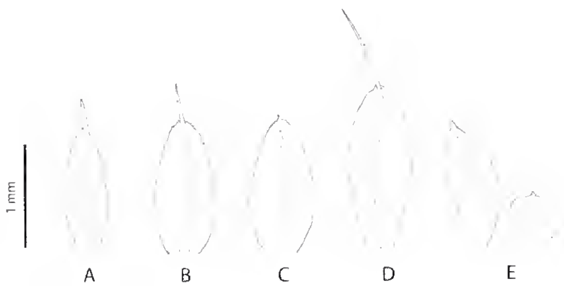

Fig. 3. Typical leaves of similar species in Victoria, shown in their moist condition. **A.** *Leptotheca gaudichaudii*. **B.** *Rhizogonium novae-hollandiae*. **C.** *Rhizogonium distichum*. **D.** *Leptostomum inclinans*. **E.** *Calomnion complanatum* – lateral and smaller dorsal leaves.

appearance and is largely confined to the trunks of tree-ferns. It is easily distinguished under a microscope because its costa is excurrent in a stout hairpoint. *H. pilifer* has been confused also with *Rhizogonium novae-hollandiae* (Brid.) Brid., which has a shortly excurrent costa, *Rhizogonium distichum* (Sw.) Brid., which lacks a hairpoint, and *Leptostomum inclinans* R.Br., which is a much larger species that grows only on tree trunks, usually in large cushions. A possible but less likely candidate for confusion is *Calomnion complanatum* (Hook.f. & Wilson) Lindb., which has an excurrent costa and a row of smaller, almost circular leaves on the dorsal side of the stem.

Representative specimens examined

Victoria – Sealers Cove, Wilsons Promontory, Mueller 171, 1854, MEL-31121; between Cape Otway and Cape Patton, Walter s.n., 1874, MEL-31120; Dandenong Ranges, Luchman s.n., 1891, MEL-31118; Barramunga Creek Education Centre, Otway Range, Beauglehole 73230, 11 Feb 1952, MEL-1042667; Maits Rest, Otways, Scott s.n., 27 May 1971, MUCV-611 (MELU); Byaduk Caves, Stone 9520, 3 Oct 1974, MEL-2190572; Melba Gully, Otways, Fuhrer & Pike s.n., 12 Dec 1984, MUCV-6166 (MELU); Kallista, Dandenong Ranges, Tomlinson s.n., 21 Aug 1985, MUCV-6482 (MELU); Chinaman Creek, Wilsons Promontory, Scott s.n. 17 Nov 1994, MELU-2999; MEL-242703; Toora–Gunyah Gunyah Road near Foster, Streimann 65283 & Pócs, 20 Sep 1999, CANB-610263, MEL-2100292; Anga-hook–Lorne State Park, Klazenga 5999, 23 Oct 2004, MEL-2131749.

Tasmania – Macrobies Gully, Bastow 66, Sep 1886, MEL-31121; Wellington Rivulet, Weymouth 100, 15 Dec 1888, MEL-2068119; Hot Springs Creek, MJ Brown 1259 & Neyland, 13 Aug 1985, CANB-376842, MEL-2037379; Russell Falls, Mount Field National Park, Stone 3250, 17 Nov 1967, MEL-2135188.

New South Wales – Monga State Forest, Streimann 51597, 13 Apr 1993, CBG-9308148.

Queensland – Border Track, Lamington National Park, Stone 4226, 19 Aug 1969, MEL-2140552, MELU (herb. Stone); Bunyip Falls, Lamington National Park, Stone 4464, 21 Aug 1969, MEL-2141638.

New Zealand – Taranaki, Fleischer B85, Apr 1903, CANB-225501; Waiatai Valley near Wairoa, Sainsbury s.n., 27 Aug 1933, CANB-360740; Rimutaka Forest, Streimann 58071, 10 Nov 1995, CBG-9704230.

Acknowledgements

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Are kangaroos indigenous to Wilsons Promontory National Park?

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Abstract

The current population of Eastern Grey Kangaroos *Macropus giganteus* on Wilsons Promontory National Park are descendants of nine animals released in the park in 1910 and 1912. Immediately prior to that there were no kangaroos in the park. There is much historic evidence to suggest that there have never been kangaroos on the Prom, but there is also one piece of information that indicates that there were kangaroos there in the second half of the 19th century. This paper draws together historic records and discusses the evidence for and against kangaroos being indigenous to the Prom. Although not conclusive, the evidence is compelling in the negative. (*The Victorian Naturalist* **125** (6) 2008, 172-177)

Keywords: kangaroos, Yanakie Isthmus, Wilsons Promontory history, Yanakie Run

Introduction

Wilsons Promontory National Park (the Prom) is located in South Gippsland, approximately 200 kilometres south-east of Melbourne. The Prom from south of Darby River was temporarily reserved as a national park in 1898 following nearly two decades of intense lobbying, led by the Field Naturalists Club of Victoria (FNCV). The park has been the subject of much research and study by field naturalists and scientists since that time.

The current population of Eastern Grey Kangaroos *Macropus giganteus* are descendants of nine animals released in the park in 1910 and 1912. The fact that there were no kangaroos on the Prom when it was first reserved is not in question (Meagher and Kohout 2001). All historical records, surveys and oral histories of the time are unequivocal on this point (Kershaw 1906). Earlier naturalists, explorers and archaeological records suggest that there have never been kangaroos on the Prom but one suggests the contrary. An article in the *Medical Journal of Australia* recounts a walking expedition undertaken by Fred Bird to the Prom in 1879 (Bird 1926) where he remarked on kangaroos around the Yanakie Homestead near the current park entrance.

History

To understand the history of kangaroos on the Prom we first need to understand the geomorphology and history of land use.

The promontory is connected to the mainland by a narrow neck of land called the Yanakie Isthmus. Formed around 6000 years ago by drifting sand, the isthmus separates Corner Inlet from Waratah Bay/Shallow Inlet. Within the Park it represents an area of 6500 ha between the current Park boundary in the north and Darby River in the south. This is the country that the kangaroos now inhabit. A further 6880 ha of farmed country to the north of the Park completes what is known as the Yanakie Isthmus (Fig.1).

Three distinct geological zones on the isthmus collectively form an area that in the 19th century constituted 'The Yanakie Run.' These zones are:

1. The acid sands airstrip area in the south (Darby River to Five-Mile Road), which the vast majority of kangaroos currently occupy;
2. The calcareous dune country between Five-Mile Road and the current park entrance;
3. The farmland between the current park boundary and an east-west line approximately 10 km north of the current park boundary, which formed the northern extremity of the isthmus.

Although the Prom was first temporarily reserved in 1898, the Yanakie Isthmus section (southern end of the Run) was added to the Park only in 1969. From the mid-1800s the isthmus was managed as a graz-

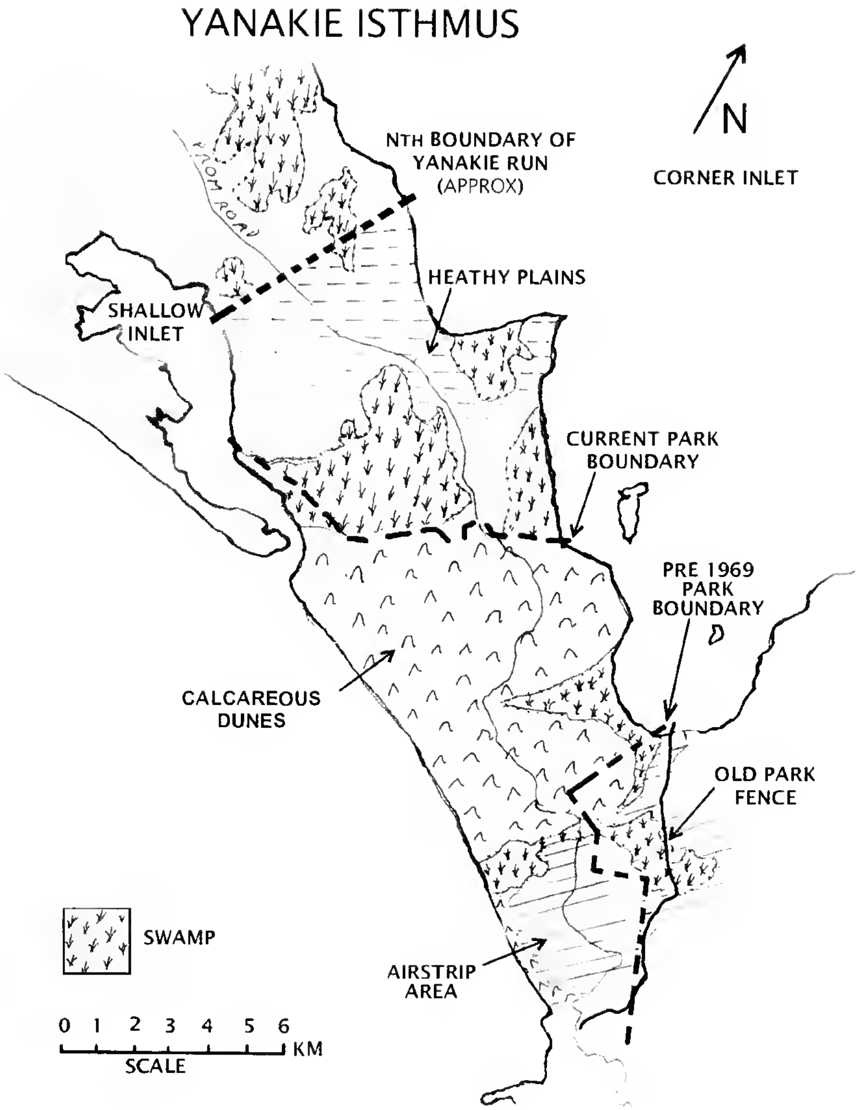

Fig. 1. Yanakie Isthmus.

ing lease, and cattle grazing continued in the park until 1992.

Early references by FNCV members and other visitors predominantly relate to land within the park, i.e. the country south of the old park fence, which spanned a disjointed line between Millers Landing and Darby River (Fig.1). Most of the grassy woodland country was outside this fence but did include some of the Airstrip area. The 1905/06 FNCV excursion passed through this area. A biological survey map showed the route of the 1905/06 expedition down the middle of the Isthmus (Hardy 1906). Hardy's report stated 'We saw nothing and could hear nothing of the Kangaroo …' and Kershaw (1906) wrote 'Kangaroos do not seem to exist on the promontory'. Their records are very clear that there were no kangaroos in the park at that time.

There were other grassy areas in the park that were suitable for kangaroos at that time, but were also devoid of them:

> In a few places there is good grass land, notably at Derby River and easterly from Oberon Bay; the parts suitable for kangaroo and emu amount to about 2000 acres ... The total amount of grazing land, [on the Prom] of good and medium quality, such as would support kangaroos ....would be perhaps 10,000 acres ... ' (Hardy 1906: 195).

The initial reservation of the Prom in 1898 provided sanctuary for Australian animals, even those not indigenous to the area (Gillbank 1998a). In 1910 a pair of kangaroos was introduced into the park by the Victorian Acclimatisation Society (Seebeck and Mansergh 1998), followed in 1912 with a further seven animals from Woodside (Kershaw 1915; Meagher and Kohout 2001; Wescott 1998). These animals remained captive behind fences at Darby River:

> In October 1936 another kind donor presented a Major Mitchell Cockatoo and this gift seems to have started the Committee toying with the idea of having an aviary built as a companion to its kangaroo paddock. (Garnett 1971)

The kangaroos remained behind wire until the fence was burnt down around 1938 and they escaped (I Park, P Gilbert, pers. comm. 2005)[1]. From such low numbers, and subject to dingo attack and hunting by humans, they would have taken some years to establish a viable population. Even when the *National Parks (Amendment) Act 1969* added part of the Yanakie Isthmus to the park, kangaroos were apparently not well established. Frankenberg (1971) records that:

> Although grazing is still permitted, the native vegetation is of great interest, and Yanakie may in time become a useful habitat for Kangaroo and Emu.

Casual observers of the current high population of kangaroos around the airstrip area may find it hard to imagine why there would not have always been a resident population. This country was once heavily timbered and not suitable for kangaroos until the trees were ringbarked and cleared in the early part of last century. The following was recorded in the FNCV Club excursion leader's report on a walk between Millers Landing and Darby River December 1914:

> About two Miles and a half from the Darby the track enters what was at one time a thickly-timbered flat, extending across the tea-tree covered sand-dunes which margin the ocean beach. Most of the timber, which consisted of principally fair-sized eucalypts, with a few scattered Blackwoods, has been ringed, only their whitened skeletons remain to show what once had been.
>
> Only a few years ago the Koala, or Native Bears were numerous, and could be seen here at any time. Wallabies, Dingoes and the introduced Hog Deer, [*Axis porcinus*] were also common ... (Kershaw 1913: 171)

The evidence for kangaroos being indigenous to the Prom

The only evidence located that refers to kangaroos on the Prom prior to 1910 is that of Fred D Bird, in a paper that he read at a meeting of the Melbourne Medical Association on September 20 1928, about a walking trip he made to the Prom 50 years earlier (1879), as a third year medical student. During his walk Bird stayed at the Yanakie Homestead which was situated near the current Park entrance. In reference to the sand-dune country around the Homestead he states boldly:

> The country, not much of which could be seen at a time, looked as if it would carry minus something of a sheep to the acre, but there were many sheep and a startling superfluity of Kangaroos. They ranged in their hundreds, even in their thousands. Each subsequent visit showed us fewer Kangaroos and now I believe they are extinct in these parts (Bird 1926: 681).

There are four points that can be made about this statement by Bird:

1. The paper runs to some 6500 words and throughout, the only mention of wildlife is the one Bird makes about kangaroos and wallabies. From that, one could deduce that natural history was not one of his strong interests. Bird could have been referring to Swamp Wallabies *Wallabia bicolor* which are prevalent on the Isthmus,

though he does also refer to wallabies in his paper.

2. Given the time between the trip and writing the article (50 years), his memory may have let him down and he could have been recalling other country he had travelled through. His route did take him through Andersons Inlet and Tarwin Lower, which would have been similar country in those days.
3. Bird says that he walked from the Yanakie Homestead to the Prom lighthouse via the coast and Oberon Bay in one (very hot), day where he stayed with the lighthouse keeper. Given that this is a distance of some 50 km, much of it without tracks, one could question his recollection. Also, that particular expedition was in 1879 yet the FNCV visit, five years later, was heralded as the first overland visit to the Lighthouse (Gregory 1885). A telegraph line was completed from Foster to the Lighthouse in 1873 (Sparkes 1997), so the associated access track would have facilitated the journey for both Bird and the FNCV.
4. His recall may be perfect and there were many kangaroos on the isthmus in 1879 but, according to an old agister from the area, 'there were never any kangaroos on the Isthmus or the country back to Fish Creek'. (Meeme Farrell pers.comm). Meeme settled in Fish Creek in 1899 and agisted cattle on the Prom and the Yanakie Run until his death in the early 1980s.

The evidence against kangaroos being indigenous to the Prom

At the time of Bird's visit, William Millar managed the Yanakie Run. Bird mentions staying with William Millar at the Yanakie Homestead on a number of occasions. Millar came to the run in 1867 as a bookkeeper for the then manager, John McHaffie (Clemson 1983). A short time later he took over the run and managed it until 1893. He was a meticulous bookkeeper (Crawford 1984).

Jim Millar, a direct descendant of William, has William's diaries and daybooks from the homestead in his possession. He has read the documents extensively and has made the following points (pers. comm.).

- In its early days the Run carried 17 000 head of sheep, which produced more than 100 bales of wool annually. The country could not have supported that number of sheep as well as a large kangaroo population.
- William Miller was an avid hunter and owned a number of fine firearms. To shoot many kangaroos would have required a lot of ammunition. There are no entries in the daybooks of large purchases of ammunition or discussions in the diaries regarding extermination of any native animals.
- Even if there had been extensive hunting of kangaroos at that time, it is unlikely that every single one of them would have been shot (Jim Millar pers. comm. 2004)

In the 1960s, Peter Coutts undertook extensive archaeological research on the Yanakie Isthmus (Coutts 1970). He concluded that kangaroos were not part of the diet of Aborigines who visited the Prom and he found no evidence of kangaroos in the excavations of middens. He did find Swamp Wallaby and Common Wombat *Vombatus ursinus*.

A number of oral histories and historical journals discuss life on the Yanakie Run. T Musgrave was the son of Captain Thomas Musgrave who was the Prom Lighthouse Keeper, appointed in 1869. As a 12-year-old, T Musgrave junior recalls travelling through Yanakie Station, 'which then carried around 17 000 head of sheep.' Musgrave joined the Yanakie Station in 1874 and worked there for about 20 years. He talks of the excitement of musters on the Yanakie Run and how one of his jobs was to take the mail etc. down to the Lighthouse once a week. This is around the same time as Bird's first visit. There is no mention of kangaroos throughout his memoirs (Musgrave 1940).

William Clemson was a Crown Land Bailiff and was responsible for administering the Yanakie Run from 1909. William's son, Ken, documented an oral history of the Yanakie Run and there is no mention of Kangaroos in the document (Clemson 1983).

These unpublished documents are available in the Wilsons Promontory Park Library. Neither of them mentions kangaroos as being present on the Prom. Whilst this is not conclusive evidence in itself it is at least indicative that kangaroos were not on the isthmus in the latter half of the 19th century.

Baron Ferdinand von Mueller was the Victorian Government Botanist for the second half of the 19th century. Mueller visited Wilsons Promontory in the 1850s and knew of the cattle station at Yanakie (The Yanakie Run) in 1853 (Gillbank 1998b). Many visitors of the time stayed at the Yanakie Homestead during their trips to the park. There is no evidence to suggest Mueller actually visited the Run but he did explore other parts of the Prom, including Sealers Cove where he stayed with the saw-millers. In 1874 he is recorded as staying at the Lighthouse (Gillbank 1998b)

In 1887, as president of the Royal Geographical Society, he was invited to lend support to the FNCV to lobby the government to reserve Wilsons Promontory as a national park. Although Mueller was a botanist, he would have been heavily involved in developing the argument for this reservation with other members of the FNCV, including Arthur Lucas, George Robinson, and John Gregory. These three men undertook a walking trip to Wilsons Promontory in 1885 (Ducker 1998). They also stayed with Millar at the Yanakie Homestead on this expedition to explore and report on the natural history of the proposed National Park.

Mueller visited the Prom 26 years before Bird, and on a number of occasions afterwards. Many other naturalists visited during that period, and the Lucas expedition was there only five years after Bird's first visit (Gillbank 1998a). Despite all of that, there were no records of kangaroos on the Prom and many references to the fact that kangaroos were absent. Surely, with all of those naturalists discussing the importance of preserving the Prom at that time, some mention would have been made of the reasons for the demise of the kangaroos if any had been there originally?

Possible reasons why kangaroos did not exist on the Prom

As indicated above, a close examination of the landforms and land use may provide clues to why kangaroos were not present on the Prom prior to 1910.

The country north of the current park boundary was deeply transected by thickly vegetated *Melaleuca* sp and wet heath swamps. The limited higher ground was covered in dense heathland. This sort of habitat was ideal for Swamp Wallabies but of no value to kangaroos until it was cleared by graziers and later drained and cleared for soldier settlement in the 1950s (Crawford 1984).

The sand dune country between the park entrance and around 5-mile Road was theoretically suitable for kangaroos, with many open grassy areas. However, as early as 1880 it was recognised that calcareous soils are highly alkaline. Alkalinity reduces the availability of micronutrients such as iron, copper, zinc and manganese (Chesterfield 1998; Parsons and Specht 1967). This leads to a nutritional problem termed 'Coasty Disease' or enzootic ataxia, which causes a wasting condition in ruminants such as sheep and deer. Ruminants have a higher requirement for cobalt than non-ruminant species, such as horses and rabbits. Studies of calcareous, coastal sand dunes of Kangaroo Island, South Australia, found that both copper and cobalt are deficient in the pastures of affected areas, and sheep required mineral supplements to survive (Underwood 1967). Kangaroos have a 'pseudo-ruminant' digestive system, and may also be limited by mineral deficiencies in these alkaline coastal soils. An extensive literature search has failed to reveal any supportive scientific evidence for this hypothesis (Davis pers. comm. 2007). Some anecdotal evidence exists for kangaroos being susceptible to Coasty Disease (Pers comm. Gilbert 2005, I Park 2005) but these observations have not been tested.

With this in mind it is possible that the sand dune country of the isthmus is not suitable to support kangaroos for any length of time. This argument is supported by the current situation where we have a large kangaroo population on the acid soil airstrip area and only sparse numbers on the alkaline calcareous dune country.

The airstrip area was heavily timbered until the early 1900s (Kershaw 1914), so was not suitable for kangaroos until it was cleared.

In essence, the only land on the Prom suitable for Kangaroos prior to 1910 was Darby River, Norman Bay, Oberon Bay and Entrance Point (Hardy 1906). The nature of the country flanked by Corner Inlet and Waratah Bay/Shallow Inlet formed a natural barrier to kangaroos accessing this country.

Conclusion

If there were kangaroos on the Prom in the 1800s we have to consider what could have led to their local extinction by 1910? Fire is unlikely to have totally destroyed the population. Even if it had, they would have recolonised relatively quickly from areas outside the park, assuming there was a local population to recolonise from. Disease is another possibility, but, again unlikely to cause local extinction. The same can be said for shooting or poisoning as a cause of extinction.

The evidence (factual and circumstantial) against kangaroos being indigenous to the park is strong and consists of archaeological reports, FNCV surveys, nature writings, oral histories and other historic records. Only one obscure reference indicates that kangaroos may have been indigenous. In the absence of corroborating evidence for that single reference, it can be concluded that kangaroos are probably not indigenous to Wilsons Promontory National Park.

Acknowledgements

I gratefully acknowledge Graeme Coulson, Naomi Davis and Linden Gillbank for their valuable input and comment, and Jo Drury for the art work.

Note

[1] Ian Park is a farmer from Hoddle in South Gippsland, and a long time agister on the Yanakie Isthmus. Perce Gilbert was caretaker of the Yanakie Airstrip following the second world war, and a former Agistment Ranger and Ranger-in-Charge at Wilsons Promontory National Park.

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Discovery of a further population of the Eltham Copper Butterfly *Paralucia pyrodiscus lucida* Crosby (Lepidoptera: Lycaenidae) in Bendigo, Victoria

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Abstract
A previously unrecorded population of *Paralucia pyrodiscus lucida*, the Eltham Copper Butterfly, was discovered in late December 2007 at Big Hill, 11 km south of Bendigo. Up to 50 adult butterflies were seen flying during sunny weather. A preliminary site description is given and the implications of this discovery are discussed. (*The Victorian Naturalist* **125** (6), 2008, 178-180)

Keywords: Eltham Copper Butterfly, *Paralucia*, population, Bendigo

Introduction

The Eltham Copper Butterfly *Paralucia pyrodiscus lucida* Crosby (ECB) is a small lycaenid butterfly endemic to Victoria. It is listed as Vulnerable under the Flora and Fauna Guarantee Act 1988. The biology of ECB is summarised by Braby (1990) and Braby *et al.* (1992, 1999). Endersby (1996) provides a detailed account of ECB natural history, ecology and behaviour. There are currently eleven protected colonies in Victoria, distributed along the south-western end of the Great Dividing Range, over a distance of approximately 400 km. A detailed description of sites can be found in Vaughan (1988), van Praagh (1996) and Canzano *et al.* (2007).

Until recently, ECB was known from three regions in Victoria. In mid-December 2007 a previously unrecorded population of Eltham Copper butterflies was discovered by JW in Big Hill, Bendigo, whilst collecting data for a conservation project. This population is approximately 30 km from the nearest known population, and is the first such significant discovery since a population was found at Kalimna Park, Castlemaine, during the 2002 flight season. The region around Bendigo represents a mixture of residential development and natural bushland. Historically, the area was mined for gold and the physical legacy of mining activities remains as part of the landscape in many areas.

ECB was first observed at the site on 5 December 2007, when two butterflies were seen flying within a patch of *Bursaria spinosa*. Further visits on 7 and 8 December resulted in observations of up to 50 adults flying during sunny weather. A return visit on 17 January 2008 yielded only two butterflies in flight. A follow-up visit by JW on February 26 yielded approximately 20 butterflies in flight, with several females ovipositing on *B. spinosa*. Formal monitoring surveys are yet to be commissioned. However, at this point the observations made at the site indicate a substantial population, comparable to that at Kalimna Park in Castlemaine. The associated attendant ant has been identified as *Notoncus capitatus* Forel, the same species of ant that attends ECB at Eltham and Castlemaine.

Site description

The recently discovered population of ECB is located at Big Hill, about 11 kilometres south of Bendigo, Victoria (144° 14' 35"E, 36° 49' 47"S). The colony occurs on a 12 hectare gazetted Reserve, currently managed by Parks Victoria (PV), as part of the Bendigo Regional Park. The Department of Sustainability and Environment (DSE) has a partnership role with PV to manage threatened species and communities. The vegetation at Big Hill is typical Box-Ironbark forest and open woodland, dominated by *Eucalyptus melliodora* and *E. polyanthemos*, with widespread scattered patches of *Bursaria spinosa*, that has several small populations of ECB. A dry creek bed runs through the main habitat area at the eastern end of the reserve, with a small foot bridge over the creek. Historically, the area was an alluvial goldmine and shallow pits and shafts are still present at the reserve. The soil type is of Ordovician age and consists of sandstone, siltstone, mudstone and shale. The Bendigo–Melbourne train line is located to the south-east, with a well-established residential area within 300 metres of the reserve.

The area of the land covered by *B. spinosa* and where the butterflies occur is approximately 10 × 50 m. Three other smaller patches of *B. spinosa* cover an area of approximately 30 × 30 m. The *B. spinosa* bushes in these patches are larger and no butterflies were present. The patches of *B. spinosa* with and without butterflies are currently being mapped. The Reserve lies adjacent to Big Hill Primary School. The students have limited access to the Reserve and its surrounds. This has been the case for many years and the population of ECB appears to have withstood this human access to the area. It is also interesting to note that the butterfly has persisted even though the landscape has been modified from past goldmining activities. The Reserve used to be known as Big Hill Public Use Reserve, with members from Big Hill Primary School and the local community involved in its management, overseen by DSE. There is an old, damaged information board at the entrance to the Reserve, which indicates that there was probably a lot of interest generated and maintained at one stage. Past management activities include a dam that was dug in 1991 as a water source for native fauna, and nest boxes installed to provide hollows. There is little evidence of past management activities that may have affected *B. spinosa*, except for removal of *Pinus radiata* stands in 1962. There are currently no existing management activities at the Reserve. However, DSE and PV are currently in negotiations for further management works to the area, including fencing and the removal of an old bridge on site.

Relevance of the new discovery and its implications

Discovery of ECB in Eltham in the late 1980s led to considerable community and political interest, and this set a precedent for insect conservation in Australia (Braby 1987). Over the years, concern for the plight of the butterfly has fluctuated somewhat. Discoveries such as this rejuvenate community awareness so that there is increased involvement in protecting the butterfly and its habitat. At Eltham and Castlemaine, involvement of members of the local community has contributed to fundraising opportunities, formation of Friends' groups, and recruitment of volunteers for monitoring and habitat management. The campaign for increasing public awareness about the Big Hill Reserve is already underway, with assistance from DSE in Bendigo and members of the ECB Recovery Team. A media release was made in late January 2008, with articles in *The Age*, *The Bendigo Advertiser* and *The Geelong Advertiser* publicising the discovery. Such publicity also endeavours to highlight the value of a threatened species within the community's regional environment. A population such as that at Big Hill reinforces the notion that native bushland has been well preserved in their region.

It is unknown whether other populations of ECB occur within the vicinity of Big Hill Reserve. ECB occurs in fragmented pockets without the ability of interchange between patches, and is still limited by specific habitat. However, there is a likelihood that ECB may be more widespread, and any opportunity for conducting new surveys in surrounding areas should not be missed. The opportunity exists for local tertiary institutions and students to become involved in further ECB and other threatened species research. The discovery of the new site may raise new questions about the natural history of ECB, and is a potential new study site offering opportunities for further understanding of the butterfly's biology, ecology and habitat requirements. There is currently no information available on genetic variation of the butterfly across different sites. Preliminary genetic studies on the closely related Bathurst Copper Butterfly *Paralucia spinifera*, indicated that heterogeneity within colonies was high but that individual colonies were closely related (NSWNPWS 2001). This may suggest that there is movement between colonies or that time since separation and isolation of the various colonies is relatively recent. It would be interesting to test whether studies of ECB show similar results. We also recommend that searches should be conducted for other invertebrate and vertebrate species that may be of conservation significance.

The immediate objective for the Big Hill population is to assess the factors which may be detrimental to the wellbeing of the butterfly. The relevant management agencies aim to identify the long-term trends of disturbance and develop ways to mitigate these to ensure the protection of the colony. A benefit here is that the land is already a gazetted Reserve, so issues with the population being under threat from development may not arise. Long-term objectives include ongoing habitat preservation through stakeholders, the Bendigo community, local schools and residents in the immediate vicinity of Big Hill. The latest discovery could be a major asset to Big Hill Primary School by incorporating study of the butterfly into the school curriculum and embracing ECB within the school community. Involvement should also extend to other local schools and businesses, which have the opportunity to develop environmental projects and adopt ECB as a symbol to promote businesses and their local region. At present no Friends group exists for the Big Hill population. However, it is understood such a group may be formed in the near future.

Acknowledgements

We are grateful to Peter Johnson (Department of Sustainability and Environment), Tim New (La Trobe University) and Alan Yen (Department of Primary Industries) for helpful comments on a draft of this paper.

This paper is dedicated to the memory of Anne Lee from Friends of Kalimna Park, Castlemaine. Anne was an active member of the Group and made the discovery of a further ECB population at Kalimna Point in Kalimna Park in 2006. Anne worked tirelessly at monitoring the butterfly and conserving its habitat and she will be sadly missed.

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Leung C (23 January 2008) Rare butterfly floats back from extinction's clutches. *The Age*, Melbourne p. 7.

Pescott T (12 February 2008) Butterflies' fragile wings need our protection. *The Geelong Advertiser*, p. 8.

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Biodiversity and survival on Mt William, Grampians National Park, Victoria

When any wildfire burns through large landscapes, it is not uncommon for small areas to remain unburnt. These sites are often in wet gullies or where wind-change spares certain areas. This was the case in the Grampians in western Victoria, where a major wildfire burnt through approximately 46% of the National Park in the summer of 2005/2006. Mt William, the highest peak in the park, was severely burnt; however, a section of the gully below the turntable car park and a significant portion near the summit escaped the fire.

During the first week of October 2007, staff and students from the School of Life and Physical Sciences, RMIT University, visited the Grampians National Park to study biodiversity. On the morning of 2 October 2007 we visited Mt William, primarily to examine the effects of the fire on vascular flora. The day was sunny with a slight breeze so there was a chance that we may also observe some vertebrates, especially reptiles and birds, that may have survived the fires or were recolonising the area. On the drive up from the valley we saw that the effects of the fire were dramatic, with lichen and moss burnt from every rock. Blackened tree trunks and branches stretched into the distance. However, resprouting was occurring everywhere with epicormic shoots adorning most trees.

As we began the one-kilometre walk to the summit White-eared Honeyeaters *Lichenostomus leucotis* were calling from Brown Stringybark *Eucalyptus baxteri* in the unburnt gully below the car park. A Grey Fantail *Rhipidura fuliginosa* also began to call and soon showed itself as it chased insects. It wasn't long before the first of many Southern Water Skinks *Eulamprus tympanum* was seen basking (Fig. 1). A further search also revealed a Tiger Snake *Notechis scutatus* of about one metre in length basking on an adjacent

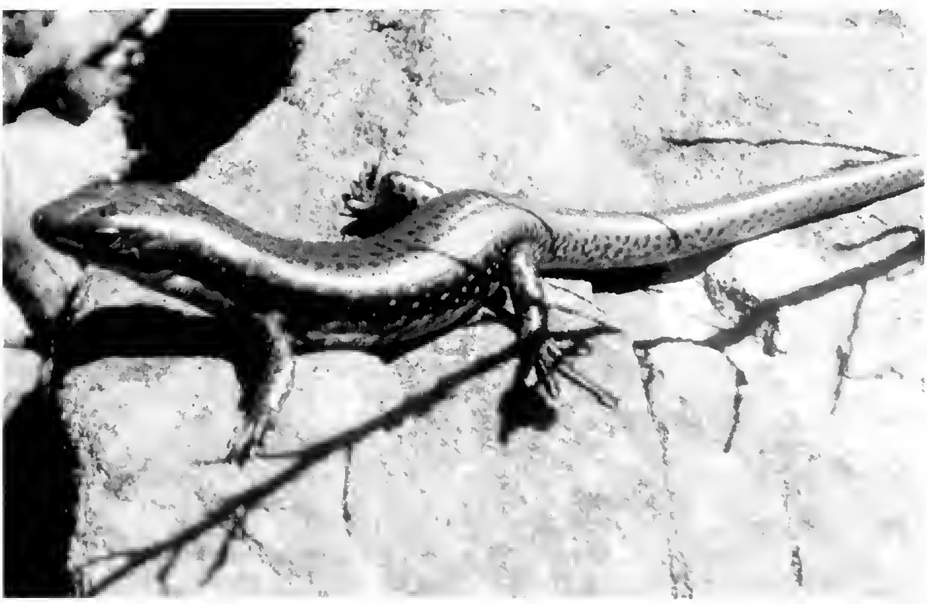

Fig. 1. Southern Water Skink *Eulamprus tympanum*. Photo by Nevil Schultz.

Fig. 2. Mountain Dragon *Rankinia diemensis*. Photo by Damien Murtagh.

boulder. Here the vegetation was of much reduced height compared to the area around the car park, and there were some healthy stands of Victorian Smoke Bush *Conospermum mitchellii* in full flower. This was in contrast to the fading flowers of the deeper pink variant of the Common Heath *Epacris impressa* nearby.

A little further up the road, in a lightly-burnt area, Common Beard Heath *Leucopogon virgatus* was in bud and flower stage. Here some students stopped to photograph a Southern Water Skink, but also noticed a small dragon basking on a nearby rock (Fig. 2). Looking closely we could see a row of enlarged spinose scales on the base of the tail, a diagnostic feature of the Mountain Dragon *Rankinia diemensis* (Wilson and Swan 2003). The Mountain Dragon reaches the western limits of its distribution in the Grampians, where the population is listed as 'data deficient' (DSE 2007). The last known record of the species from Mt William was about twenty years ago (P Robertson pers. comm), so this was an important chance sighting of a rare species, especially after such a devastating fire. The students were already familiar with the Mountain Dragon, having captured the species during pitfall trapping in Heathy Woodland near Anglesea in February 2006. The Anglesea form of the Mountain Dragon is also listed as 'data deficient' but it inhabits very different vegetation from the Montane Rocky Shrubland of Mt William.

We continued uphill into the unburnt section, where Southern Water Skinks were particularly abundant. A check of the boulders below the road revealed a basking Lowland Copperhead *Austrelaps superbus*, which disappeared rapidly as soon as it was disturbed. On the other side of the road and slightly uphill, a pair of White-browed Scrubwrens *Sericornis frontalis* were giving their typical loud alarm call, whilst flying back and forth and pointing their beaks towards the base of a shrub.

Fig.3. Pine Heath *Astroloma pinifolium*. Photo by Nevil Schultz.

Closer inspection revealed a basking Tiger Snake that flattened its neck as it sensed our presence.

On the last straight stretch before the summit a Black Rock Skink *Egernia saxatilis* was seen, but it quickly ran under a rock ledge when approached. Further on, several Gang-gang Cockatoos *Callocephalon fimbriatum* were feeding in a warty-fruited, higher altitude variant of the Brown Stringybark (formerly *Eucalyptus alpina*). Just below the summit, germination of Rock Banksia *Banksia saxicola* was prolific. The Pine Heath *Astroloma pinifolium* (Fig. 3) was in several stages of flowering at this point, its spectacular two-toned yellow and green flowers sheltered by large rocky outcrops. An Eastern Spinebill *Acanthorhynchus tenuirostris* was calling from somewhere down the slope in the thick vegetation. Our walk concluded with the Spinebill finally revealing itself as it flashed across the road and disappeared behind a mature Rock Banksia.

Acknowledgements

Thanks to Peter Robertson of Wildlife Profiles Pty Ltd, who confirmed identification of the Mountain Dragon seen on Mt William and for his comments on the species.

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The Ferocious Summer: Palmer's penguins and the warming of Antarctica

by Meredith Hooper

Publisher: *Profile Books, 2007, 299 pages, paperback; colour photographs. ISBN 1876473401. RRP $32.95*

Meredith Hooper's experiences following Dr Bill Fraser's research team as they studied Antarctic Peninsula bird life during *The Ferocious Summer* are documented in detail and the decisions behind their efforts are given a great deal of attention. The story of climate change affecting the breeding colonies of Adelie penguins near Palmer Station, the United States' year round research presence in Antarctica's west, is presented through anecdotes and observations derived from the author's close association with her subject and Antarctica in general. The summer of the book's title caused, by various mechanisms, decreased breeding success in many Adelie colonies. A more subtle effect on a less photogenic species wouldn't capture reader imagination and sympathy in the same way. In a way no other book has yet achieved, *The Ferocious Summer* links the plight of a cute species with scientific evidence that the problems are due to climate change.

The author waited for research findings to be confirmed, with the result that the book, arriving on our shelves in 2007, missed contributing to the realignment of public opinion about climate change that occurred in Australia in 2006. However, the bleak story of Palmer's penguins and the author's attention to scientific detail should be enough to make dedicated climate sceptics pay attention, if they can be encouraged to read it.

Readability was where the book fell short of my expectations.The author conveyed a sense of what it was like to work as part of a bird research team well, but other aspects of life at Palmer Station received less attention than their interest to a general audience may have warranted. More digression from the constant bird tagging and weighing would have been welcome. Some aspects of life and work in the far south were taken for granted, and this offhand manner with situations few people encounter isolated me from the author's experiences. The same story may have been more readable from someone new to the region and struggling for context and acceptance, thereby encouraging the reader to feel more a part of the story than an outsider. The writing occasionally soared but this was balanced by some surprisingly clumsy sentences from this roundly published author. Several obvious errors suggested the editors were not at their best when reviewing the work.

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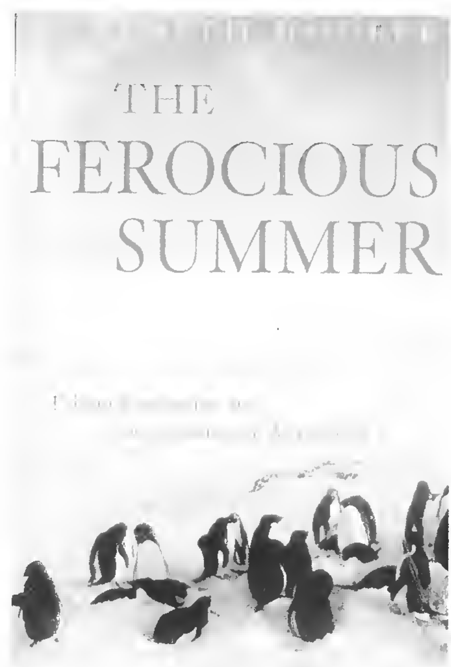

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