WALPOLE-NORNALUP NATIONAL PARKS ASSOCIATION
1987-1997

Celebrating the First 10 Years

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Over the past decade, the Walpole-Nornalup National Parks Association has earned its place as a respected community based reference point for conservation related issues and activities. Much of our success is linked to the representative nature, skills and enthusiasm of our membership which now stands at over 100 persons.

This publication, with its selection of specialist articles, photos and data is a celebration of that success. Amanda Keesing and her editorial team deserve the highest praise for producing such a quality document.

Geoff Fernie, President WNNPA

Published by:
Walpole-Nornalup National Parks Association (Inc.)
P.O. Box 8
Walpole WA 6398

Title:
Celebrating the First 10 Years
Walpole-Nornalup National Parks Association (1987-1997)

Date of publication:
December 1997

Editorial team:
Amanda Keesing
Lee Fernie
Craig Keesing
Pam Lumsden

Printed by:
Albany Printers

Cover photo: Trees beside the Frankland River, Nornalup
Pam Lumsden

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SPECIAL EUCALYPTS OF THE WNNP

Ian Brooker

Since its formation in 1987 the WNNPA has organised many speakers to address members and interested visitors. Below is a summary of Ian Brooker's lecture given in February 1989.

History of Eucalypts

• Eucalypts are of course Australia wide, two species are found in Timor, up to twenty in Papua New Guinea, one in Indonesia and one north of the equator on Mindanao Island in the Philippines.

• It is thought that the Portuguese were the first Europeans to view the eucalypt and they transported seeds from Timor to another of their colonies, Brazil in the 18th century.

• Sir Joseph Banks collected a number of eucalypt specimens from the eastern coast of Australia on Cook's first voyage in 1770. They were difficult to identify back home in England and they remained in the "too hard basket". It was not until Cook's third voyage in 1783 that one of his botanists, David Nelson collected some specimens from Bruny Island off the Tasmanian coast. They found their way to the British Museum where the French botanist, L'Heritier worked on the specimens and named it *Eucalyptus*, meaning well covered operculum cover. It was the later well known messmate *E. obliqua.* The details were published in 1788 so that in 1988 we also celebrated the bi-centenary of the *Eucalyptus* genera. (As a footnote Ian added that L'Hertier was assassinated a few years later during the French Revolution - botanists concerned with eucalypts have been assassinating each other ever since.)

• Once the genera was established further identifications followed. James Edward Smith from the British Museum named many eucalypts sent from the eastern states in the 1790s. Baron F. von Mueller at the Melbourne Botanical Gardens, a specialist in all aspects of botany, identified many specimens around Australia including our own *E. ficifolia.* Later Joseph Maiden from the Sydney Botanical Gardens named many specimens, followed by Blakely and later Johnson both from Sydney.

• Here in WA Charles Gardner, Government Botanist and Curator of the State Herbarium named a few new WA species but very little work had been done before Ian arrived in 1969. Ian has studied eucalypts for the last 19 years and during that time 50 new species have been identified and named, 20 from the Hyden/Norseman area. He worked closely with Stephen Hopper then of Wildlife Research, CALM.

The photographs of the new species were stunning and we learnt to tell the difference between a mallee, a mallet and a tree. We looked at the various ways the eucalypt deals with its bark: from the annual peeling of karri to the retention of dead bark in long strips in jarrah and to marri which holds its dead bark in broken up plates.

Five Eucalypts of the WNNP

• *E. brevistylis:* (Rate's tingle). Specimens were found at a number of sites in the eastern end of the park. We learnt to recognize them by the waxy look to the stalks, the petiolated and heart shaped young leaves, the wrinkled appearance of the fruit and the usually buttressed trunks. The flowering period is April to November, the flowers are found in the axils of the leaves, the outer stamens being without anthers.

• *E. jacksonii:* (Red tingle). Like the other tingles the adult leaves are dark green above and pale beneath. The leaves are an oblique shape with the side vein set in from the edge. There is no stalk on the juvenile leaves. The trunk is prominently buttressed and the flowering period is January to March. The bud stalk is short, the fruits are cut off globular fruits and the seeds are shiny brown and pyramid shaped.

• *E. guilfoylei:* (Yellow tingle). The adult leaves are green above and pale beneath with the side vein running close to the margin of the leaf. There is no wax on the stalks as in Rate's tingle, the peduncle is flattened, there are no stems to the buds and the bud cap often shows 4 sutures. Unlike the red tingle and to a lesser extent the Rate's tingle the trunk of the tree is not buttressed. The flowering period is November to December.

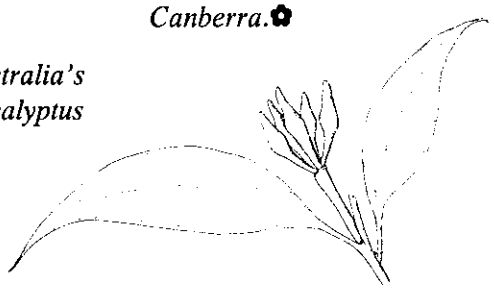
• *E. ficifolia:* (Red flowering gum). This species is often confused with marri but by examining the leaf with a hand lens the marri will be found to have numerous oil glands while *E. ficifolia* is without glands. The bark is finer than marri and its seed is reddish brown and winged while marri is black and not winged. Both have barrel like fruits but with *E. ficifolia* the neck is smaller.

• *E. staeri:* (Albany blackbutt). This eucalypt resembles the "scrubby jarrah". The leaves are concolorous as in jarrah but if examined with a hand lens no oil

glands will be seen. The bark appears to be in thicker slabs than in the jarrah.

Ian Brooker is one of Australia's leading authorities on Eucalyptus taxonomy. He is currently at the Australian National Herbarium, Canberra.✿

Eucalyptus staeri



DISTRIBUTION OF FOUR SPECIES OF ENDEMIC EUCALYPTS

Grant Wardell-Johnson

The Biogeography section at the Manjimup Research Centre has now established the domain of four species of eucalypts confined to the Walpole area. These are *Eucalyptus brevistylis* (Rate's tingle), *E. jacksonii* (red tingle), *E. ficifolia* (red flowering gum) and *E. guilfoylei* (yellow tingle - also found near Denmark)

E. brevistylis occurs in areas of granite outcrop, creek lines and the ecotone ("edge") between sandy plains and granite hills in four forest blocks: London, Soho, Crossing and Collis, east of Mt. Frankland. It also occurs as an outlier on the South Coast Highway, 5 km east of Walpole. The largest populations occur in the higher parts of the landscape (> 180 m) in Soho and Crossing forest blocks (part of the Mt. Frankland National Park) where it can occur in pure stands. It is associated with *E. megacarpa* and *E. patens* in drainage lines, *E. calophylla* near outcrops, *E. diversicolor* on gravelly loams and *E. marginata* on the ecotone between granite hills and sandy plains. Trunk diameters range to over 1.5 m with little buttressing. Heights of trees approach 50 m.

Dominant understorey species associated with *E. brevistylis* include *Lasiopetalum floribundum, Petrophile diversifolia, Agonis parviceps, Allocasuarina decussata* and *Thomasia quercifolia.*

E. jacksonii, a species closely related to *E. brevistylis* occurs associated with gravelly soils on hills and slopes within 10 km of the coast in the WNNP (including Giants block). It can occur in pure stands (eg Forest of Arms in the Nuyts Wilderness) or with *E. diversicolor, E. guilfoylei* and *E. calophylla.* Associated dominant understorey species include *Trymalium floribundum, Hibbertia furfuracea, Acacia pentadina, Lepidosperma effusum* and *Allocasuarina decussata.* Trunk diameters range to over 2.5 m with heavy buttressing in some sites (usually associated with an impedance layer). Heights of trees approach 65 m.

E. guilfoylei occurs in gravelly soils with a high clay content at less than 50 cm depth as far north as Sharp block near Mt. Frankland, east to the Bow River and Collis forest block and west to the SW Highway near Centre Road. Important remnant outlying populations occur near Denmark. This species can occur in pure stands (rarely) or associated with *E. marginata, E. calophylla, E. jacksonii* and *E. diversicolor. E. guilfoylei* occurs in association with *E. megacarpa* and *E. calophylla* on granite outcrops at Mt. Hopkins. Tree diameters rarely exceed 1 m with little or no buttressing. Heights range to 50 m but are usually much less. This species produces abundant flowers between November and mid-January and always has a large seed crop. Flowering can take place within ten years of germination.

E. ficifolia occurs on humic podzols. The largest populations occur along Boronia, Mountain and Middle Roads in Crossing, Soho, London and Thames forest blocks; along Gum Link Road in Thames forest block and along Ficifolia Road near Peaceful Bay in the WNNP. An outlier occurs along Dingo Flat Road. It is usually associated with *E. marginata* and *E. patens* and less commonly with *E. staeri* and *E. megacarpa.* Associated dominant species include *Banksia ilicifolia, B. attenuata, B. quercifolia, Allocasuarina fraseriana* and *Dasypogon bromeliifolius.* Tree diameters rarely exceed 50 cm and often show signs of fire scarring ("dry siding" or "hollowbutting"). Heights rarely exceed 10 m. An outstanding specimen along Boronia Road is nearly 20 m tall. Flowering during 1990 was outstanding between January and mid-March.

Grant Wardell-Johnson was an inaugural member of the Association's committee and a Research Officer with CALM at Manjimup and Woodvale during the 1980s and 90s. He is presently a Senior Lecturer at the University of Namibia.

Postscript: January - March 1997 was another spectacular year for the flowering of *E. ficifolia* (see Newsletter 39).✿

POSSUMS IN THE PARK

Ric How

The following are notes taken from Ric How's lecture to the Association in December 1990.

Up to 40 species of possum are to be found around the periphery of Australia, but in WA they are confined to isolated habitats in the south west and the Kimberley. The greatest concentrations in Australia are in the rainforests of northern Queensland.

Although four species may be found in the WNNP they are now uncommon throughout the area. History records they were here in greater numbers at the turn of the century but the numbers have declined dramatically. In other parts of the country, including many suburban situations in eastern Australia, this is not the situation. Why have they declined? Ric and his colleagues would like to answer this question. Introduced predators such as the fox and cat must have played their part but the district's pioneer families talk of an unknown disease that decimated the possum population in the 1930s. This disease would have to be identified before they could be re-introduced into the area.

Notes on the four species in the park follow.

Pygmy possum

• The size of a small mouse with a prehensile tail a little longer than the body, about 150 - 175 mm total length.

• They are insect and nectar feeders.

• When found they are often in a torpid condition due to their ability to lower body temperature and to enter a state similar to hibernation.

• The pygmy possum is an important marsupial ranging from the eastern goldfields to the forests of the south west. Scientists are not sure how they adjust to these differing habitats.

Common brushtail possum

• About the size of a domestic cat the brushtail of the south west has a characteristic white bushy tail tip.

• They are the most widely spread of possums found in the Kimberley and the south west but sadly the species appears to be rare in our national park. (More recent sightings in 1997 in a number of locations may change this perception.)

Western ringtail possum

• About 600 mm in length and smaller than a domestic cat.

• It is dark brown to black in colour (not grey) with a prehensile tail which is furred, (not bushy) with a longer white tip than the common brushtail.

• It has characteristic large eyes.

• The south west ringtails are a different species from those in eastern Australia and scientists are now examining the possibility that in WA there may be a number of different species each with its own ecological niche.

• Ringtails are nest builders and their nests or dreys are found in the peppermint forests and the *Agonis flexuosa* stands in the dune areas.

Honey possum (our logo→)

• The honey possum may be found from Kalbarri to the south west and across to Israelite Bay with outlier groups further to the east.

• It is no longer considered to be a true possum.

• Having a close association with the flowering sand plain flora it requires large areas for its habitat

• A fire sensitive species.

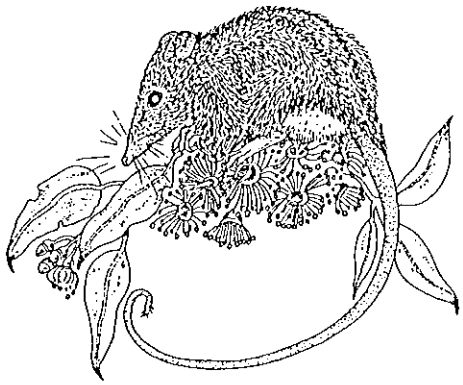
• The size of a mouse, it has the fewest teeth of any marsupial (22) and feeds on nectar and pollen.

• It breeds all year round, while having young in the pouch more are waiting to be born.

After the beautiful slides we all crammed into three vehicles with spotlights and searched hopefully for possums in the forest along the Pedro Fire Line, Frankland River and Tingle Drive. We were disappointed to confirm that possums are not easy to find in our park.

Ric How is currently in the Terrestrial Vertebrates Section of the WA Museum.

Postscript: Reports during the past year of sightings of the Common brushtail possum in varied areas including John Rate Lookout, Coalmine Beach, Nornalup, Kammenn Block and forested areas of agricultural land off Allen Road are hopeful signs. ✿



THE HEALTH OF OUR INLETS

Tim Carruthers

The Walpole-Nornalup Inlet system is unique in several ways such as its natural permanent bar opening and the fact that the land around the Nornalup Inlet is national park and undisturbed. There are two areas of potential concern for the health of this system in the future. The first concern is that the Frankland River provides a large amount of the inlet's water and is feeding from a large agricultural catchment. Land clearing leads to increases in erosion and high nutrient loads (either attached to sediment or in water column). This is bad both for the owners of the agricultural land (who lose nutrients and sediment) and the health of the inlets (which gain nutrients and sediment). Revegetation of the water courses of the Frankland River and its tributaries should be encouraged in any way possible. The second potential concern which was identified as more important in the EPA *Estuarine Studies Series* (1988), is point sources of pollution into the Walpole Inlet itself. This section of the system does not receive the same amount of flushing as the larger Nornalup section. Therefore it appears that there is a greater build up of organics and sediment within the Walpole Inlet. Continued nutrient addition from human sources and low flushing may result in nutrient levels building up to an extent that micro and macro algal blooms result. This has happened in many closed and semi-enclosed systems around the world and methods to reduce addition of nutrients, especially from septic systems and road drains, should be considered urgently. These could include reduction of overflow from road drains with baffling vegetation and reduction in the number of septic systems seeping into the inlet. Finally, there has not been a thorough survey of the aquatic vegetation of the Walpole-Nornalup system, this would be beneficial as it would allow a better understanding of the ecology of the inlet. This would also provide a point of comparison if changes occur.

Tim Carruthers is a postgraduate student at the Botany Department of the University of Western Australia. ✿

Wild and Scenic Rivers Classification and Protection

The Waters and Rivers Commission has participated in a national study funded by the Commonwealth Government aimed at identifying all "wild" rivers throughout Australia. The study is being undertaken by the Australian Heritage Commission on behalf of the Commonwealth. Wild (pristine or near pristine) rivers have been defined for the purpose of the study as:

"those rivers which are undisturbed by the impacts of modern technological society. They remain undammed and exist within catchments where biological and hydrological processes continue without significant disturbance. They occur within a variety of landscapes, and may be permanent, seasonal, or dry watercourses which flow only occasionally".

Approximately 30 "wild" rivers have been tentatively identified in Western Australia. However the results are awaiting field verification. They are also awaiting coordination (agreement) of size related parameters, such as minimum length and mean annual flow volume, with the other states.

The "wild" rivers identified for the national study could form the natural (pristine or undisturbed) component which, together with rivers considered to have historic significance and/or outstanding recreational use value (such as sections of the Avon and Blackwood Rivers), could form the basis of Western Australian heritage river legislation at some time in the future.

The Shannon, flowing into the western end of Broke Inlet with its catchment entirely in national park, is likely to receive the support of the W.A. National Parks and Reserves Association for designation as a wild river. Our Association is also promoting the mid section of the Deep River for classification, with its attendant requirement of integrated catchment management planning. Such a designation, with appropriate management, will have clear nature based tourism benefits to the town of Walpole.

FROGS OF THE WALPOLE REGION

Dale Roberts

The south coast near Walpole shares many of its fifteen frogs with the southwest forests from Perth to Albany. However, the area also has two endemic frog species.

The Walpole frog, *Geocrinia lutea* occurs between the Deep and Frankland Rivers from the coast north to about Mount Frankland. The Walpole frog is one of four related species of *Geocrinia* found across the high rainfall zone from Walpole to Margaret River. All four deposit eggs in small burrows where the eggs hatch but the tadpoles metamorphose direct from the egg jelly as a fully formed frog without feeding or ever entering water. This is known as direct development. Although its range is small this species occurs in many creek systems and is abundant. The continuous call, tik-tik-tik....., is common in spring and early summer though the frogs are well hidden at ground level in some of the densest swamps.

The black, orange and blue colours of the sunset frog, *Spicospina flammocaerulea*, make it one of Australia's most recognisable frogs. Discovered by Pierre Horwitz during a survey of wetlands across the high rainfall zone of southwestern Australia in 1994 it was formally described in 1997. This frog not only has a distinct colour but also unique, triangular spines on the third vertebra which led to its generic name - *spico* for spine, *spina* for the vertebra.

The sunset frog calls and breeds in spring and early summer. Males make their distinctive, du-duk call, from shallow seepages or ponds. The eggs are laid in water one at a time with the pair moving after each egg is released. No information is available on tadpole form or development but there are no indications that the sunset frog has any peculiarities comparable to the direct development seen in the Walpole frog. The same breeding sites are used during winter and early spring by the quacking frog, *Crinia georgiana* and Glauert's froglet, *Crinia glauerti* and in the autumn by Lea's froglet, *Geocrinia leai*.

Studies of molecular evolution in frogs and other organisms indicate that some molecules, eg. albumin (an abundant molecule in the blood plasma of vertebrates), evolve at a roughly constant rate - a molecular clock. This means that changes in the structure of albumin can be used to date the evolution of modern vertebrate groups and this has been done with many Australian frogs. Based on albumin molecular clocks, *Spicospina* may be very old with an estimated age of divergence from its closest relatives of just over 30 million years!

The sunset frog is known from only eight populations in an area northeast of Walpole. Its complete range may be as small as 50 - 60 km^2 with the area of critical, suitable habitat much smaller. This is one of the smallest, natural geographic ranges of any terrestrial vertebrate known in Australia. The number of males calling, the best clue to population size available so far, varies dramatically from night to night and year to year so there are no reliable data on how many frogs might be out there. However, the small area of apparently suitable habitat at all known swamps indicates that population sizes are almost certain to be small - possibly less than fifty frogs at several sites.

Sunset frogs occur high in the landscape with most records at elevations of 100 metres or more. They are found in seepages and hollows in deep peat beds in the head waters of stream systems - not in the lowland swamp systems that flood in winter. Both the Walpole and sunset frogs may have adapted to using available moisture in spring and summer because higher temperatures lead to faster tadpole development. The peat swamp systems will require careful management to retain these seasonal wetting characteristics: features that might be affected by inappropriate fire regimes, dieback infestation of sur-

Field Trips

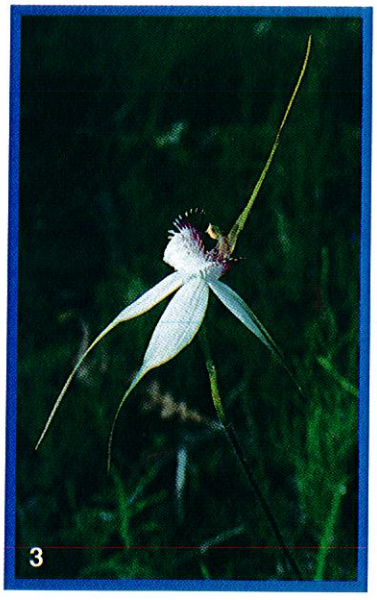
Over the last 10 years the Association has organised an astounding 75 field trips. We've been up mountains, over inlets, through forests, counted ducks, and located fungi, orchids, lillies, marsupials, birds, frogs, ants and spiders to name but a few.

Part of the Association's role is to give members and their families an opportunity to visit somewhere new or to learn more about our national park's flora, fauna, history, geography etc. Many of our field trips have been guided by Association members - there are many authorities in their respective fields within our membership.

rounding vegetation or poor road design which could lead to flooding or erosion problems.

The sunset frog is an exciting discovery and presents some important conservation issues. Its discovery emphasises again the uniqueness of the high rainfall zone of the south coast of Western Australaia with its ancient landscapes and complex patterns of isolation generated by rising and falling sea levels among the mountains and hill systems over the last 50 million years

Dale Roberts is a Senior Lecturer in Zoology at the University of Western Australia. ✿



1. The underside of the sunset frog *Spicospina flammocaerulea.* *Photo: Dale Roberts.*
2. Sunset frog *Spicospina flammocaerulea.* *Photo: Dale Roberts.*
3. Walpole or Heath spider orchid *Caladenia interjacens.* *Photo: Bill Jackson.*
4. Jackson's sun orchid *Thelymitra jacksonii.*

WALPOLE'S NATIVE ORCHIDS

Bill Jackson

The South West land division of Western Australia is known world wide for its unique and beautiful flora.

Our Association's area of interest in the high rainfall conservation estate of the south coast around Walpole, is home to a wide variety of native terrestrial orchids. The number of species/sub-species and variations recorded in our area is greater than in any comparable area in Australia.

The diverse land forms, soils and vegetation types within our national parks, provide habitat for more than 100 species. The entire south west of Western Australia is known to have 27 genera, and 23 of these are found in our parks.

Only 4 of the 27 genera are not currently recorded in our parks:

- *Spiculaea* (Elbow orchid) - single species genus
- *Genoplesium* (Pygmy orchid) - single species orchid
- *Rhizanthella* (Underground orchid) - single species orchid
- *Drakonorchis* (Dragon orchid)

Based on my experience as a volunteer flora surveyor and my special interest in our native orchids, I have no doubt that many more species will be named in the next few years.

A state wide comparison (below) shows the proportion of species within six genera found in the WNNP. Species in the other 18 genera are less well known, as they are generally less attractive or not easily seen in their natural habitat. These include the unique and fascinating *Paracaleana* (Duck orchids), *Drakaea* (Hammer orchids), *Corybas* (Helmet orchids), *Cyrtostylis* (Mosquito orchids) and *Calochilus* (Beard orchids).

Our native orchids depend on particular soil fungi for germination and appropriate pollinators for fertilization, these are generally bees, wasps, mosquitos, flies, gnats and ants. A few orchid species have methods of self pollination and do not require an outside source. These flowers open very briefly, if at all, a very frustrating experience for someone closely monitoring a plant only to find it gone to seed without ever opening.

It is well known that many of our native plants entice their pollinators by providing a reward such as nectar. However a number of native orchids in the genera *Paracaleana, Cryptostylis* and *Drakaea* have evolved techniques which sexually attract the male of the pollinating species.

The only 'white spider' endemic to the coastal heathland is *Caladenia interjacens,* commonly known as the Walpole or Heath white spider, its clubbed sepals identifying it from others in the white spider tribe.

Thelymitra jacksonii is also closely associated with Walpole, being discovered north west of the town in December 1987 by the writer. Initially thought to be a species growing in the Darling Ranges *(Thelymitra stellata)*, it was subsequently described and named by Stephen Hopper as a new species.

The wide variety of habitats found in our national parks - coastal dunes and granite, swamps and wetlands, forests, inland granite outcrops and riverine areas, are home to some 85% of the orchid genera to be found in Western Australia's South West land division. This diversity of habitat, soils and vegetation types is why we have over 100 species recorded currently.

The critical association between orchid species and their habitat requirements is well documented. Some examples are:-

1. *Corybas abditus* - long unburnt winter wet swamps with dense overhead vegetation excluding sunlight.
2. *Eriochilus pulchellus* - restricted to shallow moss/soil on granite outcrops.
3. *Epiblema grandiflorum* - in wet depressions and flats - plants generally in water.

A state wide comparison shows the proportion of species within six genera found in the WNNP.

Genus		Species in WNNP	Species in WA (approx)
Caladenia	Spider orchids	22	130
Thelymitra	Sun orchids	16	28
Prasophyllum	Leek orchids	13	24
Pterostylis	Greenhoods	17	64
Eriochilus	Bunny orchids	9	10
Diuris	Donkey orchids	8	27

In contrast there are other species which are to be found in a variety of habitats. Examples are *Caladenia flava* (Cowslip orchid) and *Caladenia latifolia* (Pink fairy orchid).

Two species of orchids appear to require fire at an appropriate time and of required intensity to bring about flowering. These are *Caladenia evanescens* (a spider orchid), and *Microtis globula*. Both have been recorded in our area, but not seen for some years past. By contrast there are orchid species for whom fire was believed to be very essential for flowering, but are now known to flower without it. A good example is our common *Leporella fimbriata* (Hare orchid).

Not so long ago the orchid season was generally accepted to start in late autumn and be over by early summer. Not so any more. An upsurge in interest amongst the general public, helped by the availability of updated information (*Hoffman & Brown Orchids of South West Australia.* Perth. 1992) has led not only to discovery of many new species, but also extensive increases to the ranges of known species. Habitats previously thought to be completely unsuitable have had orchids recorded in them.

In our south coast national parks there is no month of the year when at least one species cannot be found in flower.

Orchid trivia

• Carolus Linnaeus in 1753 named the genus 'Orchis' (Greek).

• John Lindley named the family *Orchidaceae* in 1836.

• Antarctica is the only continent where orchids have not been recorded.

• Approximately 10% of the world's flowering plants are orchids.

• Australia is known to have over 100 genera and in excess of 600 species.

• Orchids form approximately 4% of Australia's flora.

• About 70% of Australian orchids are terrestrial.

• Reproductive parts are fused in a single 'column' like structure.

Bill Jackson is inaugural and past president (1987-1993) of the WN-NPA.

Fungi Research

Our Association, in conjunction with the CSIRO, is currently managing a major study on the relationship between fungi, soil temperature/soil moisture content and litter cover in the southern jarrah forest. This is the second of two important studies funded by the Lotteries Commission through the Gordon Reid Foundation for Conservation. Members Katie and Alex Syme and Mary Hart are principal participants. The report on the first study, completed in July 1997, has received favourable comment.

FUNGI GROWING WITH TINGLE AND KARRI IN THE WALPOLE-NORNALUP NATIONAL PARK

Katrina Syme

There has been no research carried out to see whether any fungi grow exclusively in the tingle and karri forests of Walpole. However, the area harbours a very rich and diverse fungus flora and has, for many years, attracted the attention of mycologists. In 1989 Professor Orson K. Miller came to Australia from the USA on a collecting trip and was brought to Walpole because of the range of fungi to be found there. He subsequently published papers on four *Amanitas* growing with red tingle - *Amanita fibrillopes*, found on Gully Road, *A. brunneibulbosa*, *A. walpolei* and *A. luteivolvata*, all of which are species having a mycorrhizal, or mutually beneficial, relationship with trees and other plants. Others in this group are the Gondwanan relict species *Rozites symeae*, first found under red tingle at Hilltop in 1993 and the magnificent *Cortinarius lavendulensis* from Monastery Road.

There are many interesting truffle-like fungi bearing a mycorrhizal relationship with plants, providing an important food source for the quokkas, bandicoots and native rats found in the Walpole-Nornalup National Park and relying on them to spread their spores. Species of *Thaxterogaster, Chamonyxia, Descomyces* and *Gastroboletus* have been collected in various locations such as Shedley Drive, Monastery Road and Tingle Drive.

The largest group of fungi live on dead organic matter and therefore play a vital role in a healthy ecosystem. In undisturbed forest the rate of build up of leaf litter and other

debris is equalled by the rate at which it is broken down by fungi and other organisms. There are vast numbers of them to be found in the forest, including the parasol mushroom *Macrolepiota konradii* and the strange basket fungus *Ileodictyon gracilis*, collected at Mount Clare.

Parasitic fungi such as *Armillaria luteobubalina* also fruit here. A serious carbonising decay in its host is caused by the beefsteak fungus, *Fistulina hepatica*, collected on red tingle at Cemetery Road.

Since there are many more fungi than plants in Australia, it follows that there are hundreds more species to be discovered. Those named here are therefore only a very small hint of what truly exists in our forests.

Further information on *Rozites symeae*

Whilst searching for fungi with Dr Neale Bougher, his CSIRO colleagues and friends in 1995, I discovered one *Rozites* in forest off Thomson Road, North Walpole. After a great search more were found, but I can't remember all the details because they subsequently formed part of the CSIRO collections. However last year driving home from the fungus study being carried out in the southern jarrah forest, Mary Hart and I stopped to have a look in an interesting bit of bush and found a small *Rozites symeae* under *Agonis parviceps* and *Eucalyptus patens*. This year, we decided on a more thorough search and Frances Ingram, one of our volunteers, found the first of them. We were too late by a few days to see them *en masse*, (there must have been forty or more) but we managed to find a number of perfect fungi for Herbarium specimens, including an immature one - the first seen with the partial veil intact. This veil is white and membranous, and overlaps the margin of the cap, which is violet. (There was a hint of this in only one of the first specimens collected at Hilltop.) This colour quickly fades and the cap becomes uniformly pale rust in colour.

I am pleased to be able to report that two more locations for this fungus have been found, after discovering that part of the new Hilltop walktrail goes through the middle of the small area where the *Rozites* was first found! I wasn't able to visit this year to see whether any more have fruited there, but I am confident that they will reappear.

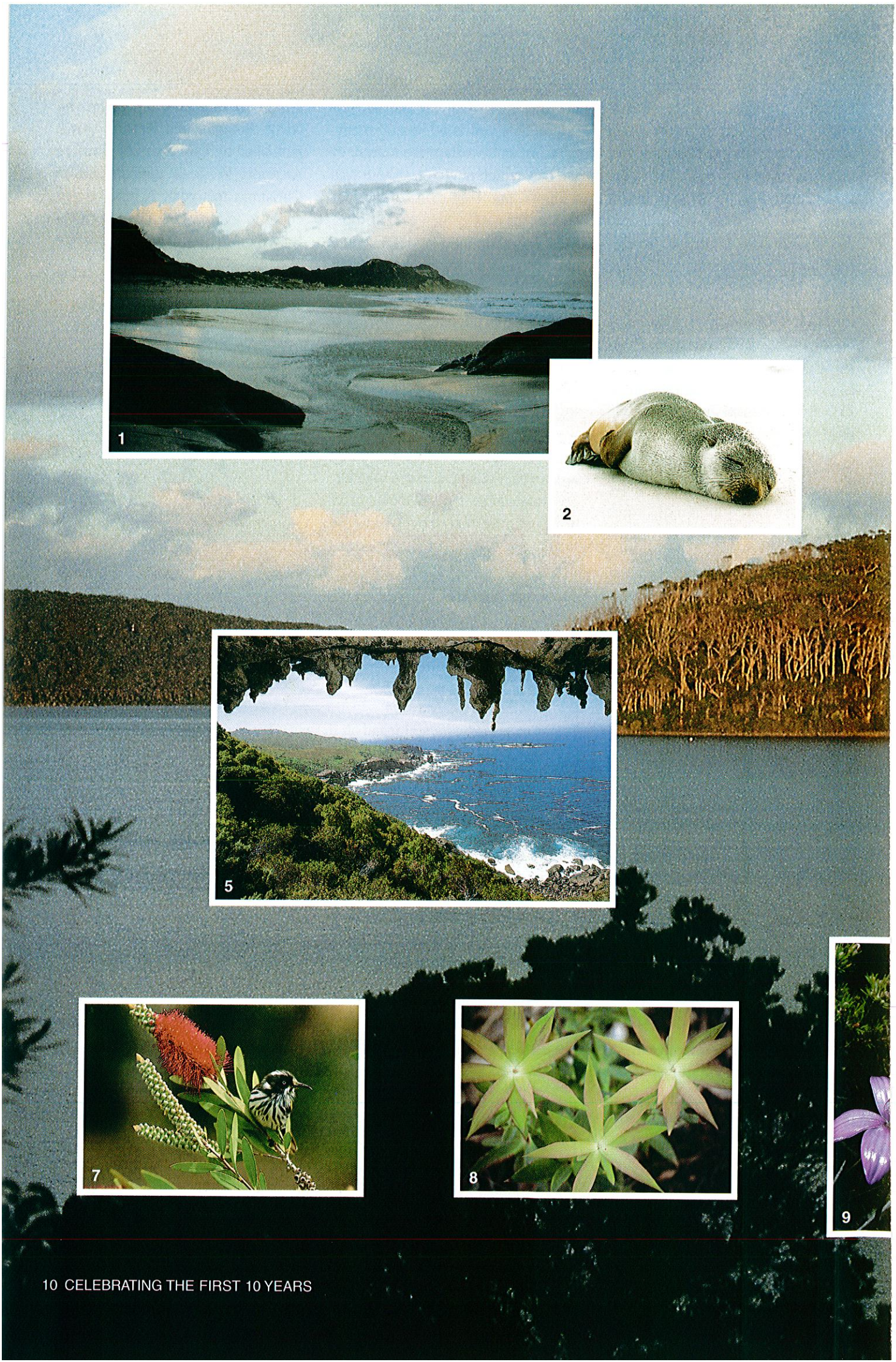
Katrina Syme, an inaugural member of the WNNPA, is a mycologist and botanical illustrator.

'Fungi of Southern Australia' by Neale Bougher and Katrina Syme, published by University of Western Australia Press, is due out before Christmas this year. A magnificent addition to your reference library - Ed. ✿

Rozites symeae

1. Mandalay Beach.
   Photo: Pam Lumsden.
2. Sub-antarctic fur seal found on Bellanger Beach. This was noteworthy as usually only New Zealand fur seals and Australian sea lions inhabit this coastline.
   Photo: Craig Keesing.
3. Red flowering gum (*Eucalyptus ficifolia*).
   Photo: Jiri Lochman.
4. Western pygmy possum (*Cercartetus concinnus*).
   Photo: Jiri Lochman.
5. Aldridge Cove in the Nuyts wilderness.
   Photo: Jiri Lochman.
6. Western tiger snake (*Notechis scutatus occidentalis*). In the local Aboriginal language Nornalup means 'home of the black snake'.
   Photo: Jiri Lochman.
7. New Holland honeyeater (*Phylidonyris novaehollandiae*).
   Photo: Pam Lumsden.
8. Tassel flower (*Leucopogon verticillatus*).
   Photo: Pam Lumsden.
9. Purple enamel orchid (*Elythranthera brunonis*).
   Photo: Craig Keesing.
10. Cowslip orchids (*Caladenia flava*).
    Photo: Craig Keesing.
11. Swamp bottlebrush (*Beaufortia sparsa*).
    Photo: Pam Lumsden.

Background: View across the Nornalup Inlet to the Knolls.
Photo: Rod Annear.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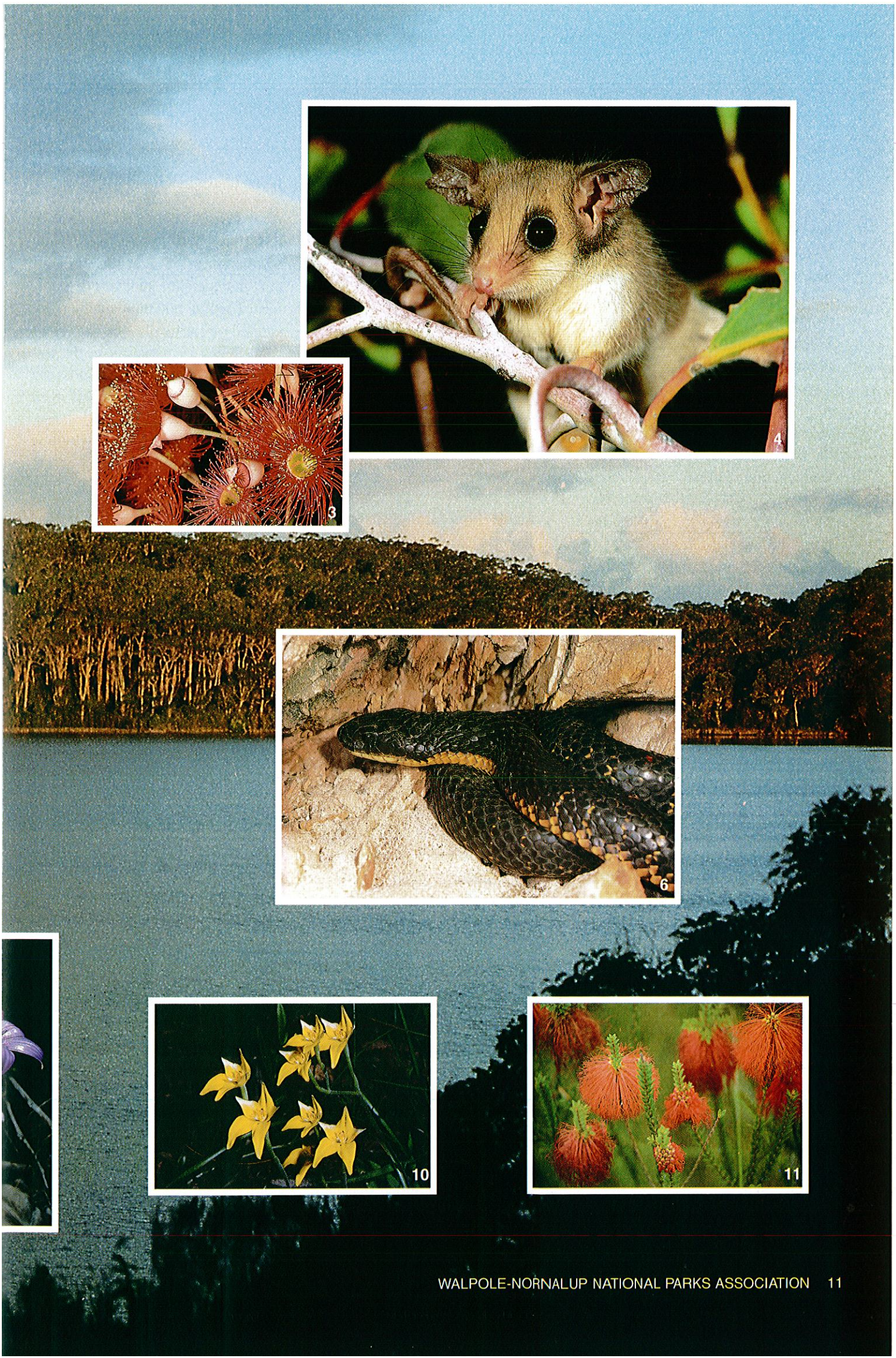
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THE MOUNT FRANKLAND NATIONAL PARK

Barney J. White

An opportunity to favour the conservation of natural values through reservation presented itself in the 1970s. At that time conservation had won sufficient support at government levels for positive action to be taken. Two successful state government initiatives were the appointment of the Conservation Through Reserves Committee (CTRC, an offshoot of the Environmental Protection Authority), and the adoption of a policy of multiple use by the Forests Dept (now CALM). The Mount Frankland National Park had its origin in the latter initiative. Multiple use gave official recognition to the conservation value of state forest, which hitherto had the continuity of timber supply as its primary 'raison d'etre'.

The general situation with regards southern forests (including the karri) at that time was that the eastern half (east of the Deeside Coast Rd.) was mainly still virgin, while its western half had supported the timber industry for the 50 or so years of its existence till then. The latter had consequently been widely cut over and converted to regrowth, though considerable tracts still remained virgin. The eastern half, being also mainly free of agricultural clearing, therefore presented a precious and perhaps final opportunity for reservation of undisturbed natural values. Consequent to its recently adopted policy of multiple use, the Forests Dept., intent upon demonstrating its environmental responsibility, was prepared to set aside from commercial utilization areas, adequate in scientific terms, of state forest under its control. It was aware that little karri forest existed outside state forest. I was one of the privileged few given the task of recommending areas of southern forest for this purpose.

What is now the Mount Frankland National Park was one of numerous areas chosen as what were then called Management Priority Areas (MPAs) for the conservation of flora and fauna. The aim was to encompass in reserves withdrawn from utilization the entire range of vegetation associations known at the time.

Available biological data seldom exceeds that deemed necessary for operational decision making, and this project was no exception. Of invaluable assistance were the Aerial Photographic Interpretation (API) maps prepared by the Forests Dept. These used a structural classification system of plant communities which combined height/life form of dominant plants and the projective area of ground covered by the foliage of dominant plants in the ecosystem Within these structural subdivisions species composition of the over storey was used to define forest types. Unusual species, rock outcrops, rivers and streams, lakes, reed swamps, sedge or heathlands, riverine communities and degree of fire damage in the overstorey were other useful features shown. Few tracts of forest elsewhere in Australia would have the equivalent coverage at that time. The lead given by the Australian Academy of Science of concentrating on vegetation associations was followed. Knowledge of fauna associations being limited at the time, it was assumed that conservation of habitat would automatically achieve conservation of the fauna dependent upon it.

As well as the above we had access to a treasury of knowledge held in the memories of older forestry staff and members of pioneering families. Though not published or described scientifically, they revealed such things as variation in the understorey and scrub layer across the forest from east to west and with increasing distance from the coast. Many were prepared to divulge hitherto guarded knowledge of the location of pitcher plants, boronia patches, enclaves of exceptional height-girth of trees, rare or undescribed species and colonies of rare fauna etc.

Representation of maximum vegetation diversity within MPAs was the primary aim. Examples of all known associations and their variations were sought and replicated if possible. Naturally the karri forest figured large, but it was considered more important to include the range from the height of its expression in very tall pure stands through to its scattered occurrence in mixed species stands of low height, than to encompass large tracts of average quality. Inclusion of forest types other than karri (jarrah, marri, jarrah-marri, blackbutt, tingles, bullich, banksia, sheoak, peppermint, Warren River cedar etc.) was imperative. Of no less importance were non forest complexes (rock outcrops, wetlands, sedge-heathlands, dunes etc.), indeed the poorest, most infertile complexes were often the most species rich.

Using the API maps appropriately coloured to highlight diversity, it was a fairly straight forward task to demarcate areas containing greatest

diversity. Seldom was it necessary to extract area data to choose between alternatives. The best options were usually self evident. Occurrences of rare species often seemed to be concentrated (Rate's tingle, red flowering gum, mallee form blackbutt and rare banksias occurred together east of the Frankland River).

The Academy of Science stressed the importance of size and shape of reserve. It also stressed the value to conservation of reserves for purposes other than conservation (timber, water etc.). Following this line of reasoning, the whole of the publicly owned forest estate was looked upon as a useful reserve of benefit to conservation. Reservation within its general extent of specific areas solely for conservation of natural values was considered to be a way of maximising conservation values of the whole, rather than looking upon them as islands within a hostile surround. This had implications for decisions particularly upon their shape. What is now the Mount Frankland National Park acquired a rather elongated NW-SE orientation to permit the inclusion of at least four significant granite outcrops, portions of two major river valleys (Deep and Frankland), an entire subcatchment of the Weld River, a wealth of vegetation associations, and a number of rare species.

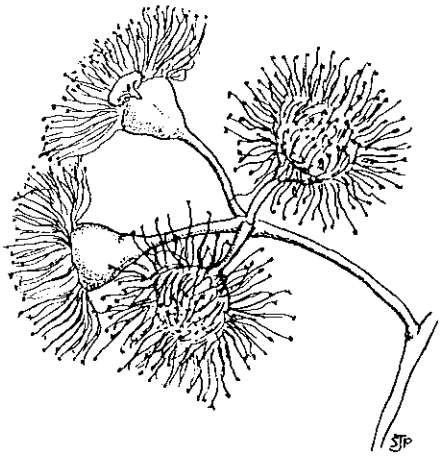
Severely fire damaged stands were avoided for reservation not because of any imagined biological inferiority, but because fire damage was a natural variant which could, or most likely would by chance, be added at a later date. Existing wide spread tracts of severely fire damaged forest were considered better scheduled for prompt commercial utilization and subsequent protection as regrowth stands.

It is interesting that this MPA was later chosen as a national park because such was not the intention during the selection process. Its selection as a national park was welcomed by me because during my years spent working there I had developed a strong emotional attachment to its aesthetic-spiritual qualities.

I remain strongly in favour of recognition of the interdependence and complementary nature of the two approaches to conservation (national parks/nature reserves and state forest). Biological diversity gains both through the maximisation of the total area given over to the conservation of natural ecosystems and in the reliable source of funding for research and management which so far wood harvest provides a substantial component.

My hope is that focus kept on maximising biological diversity in the entire forest estate will bring about sensible joint management.

Barney White is a retired, respected senior Forester who worked for the Forests Department and CALM for 37 years.



Eucalyptus calophylla flowers.

Management Plans for National Parks

Several national parks and nature reserves in Western Australia are fortunate in having a statutory management plan.

The current management plan for the WNNP (1992-2002) outlines the goals, objectives, strategies and actions to protect and conserve the park's values and enhance visitor appreciation of the park. The Association assisted in the preparation of this management plan and carried out a mid-term review of progress.

At present an interim management plan for the Mt. Frankland National Park is being drawn up. Unfortunately there is little baseline data available on flora and fauna. Again we will co-operate in developing appropriately cautious management planning.

The Association is actively involved with a number of decision making bodies as well as CALM. Representatives have attended Regional Forest Agreement stakeholders meetings and the Dieback Review Panel information sessions. Productive discussions with Main Roads on passing lane plans for the South Coastal Highway between Nornalup and Bow Bridge were concluded earlier this year. Site assessments for the proposed Walpole Sewerage Treatment Plan were forwarded to the DCE. A submission has been sent to the Shire of Manjimup on the planning of a campsite and the future of the current settlement at Broke Inlet.

Members Bill Jackson and Ted Middleton regularly assist CALM and the W.A. Herbarium in the search for rare flora.

We also have a record of cooperation with other groups including the Tourist Bureau and the Walpole Nornalup and Districts Historical Society.

Prescribed Burning Trial in the Red Tingle Forest

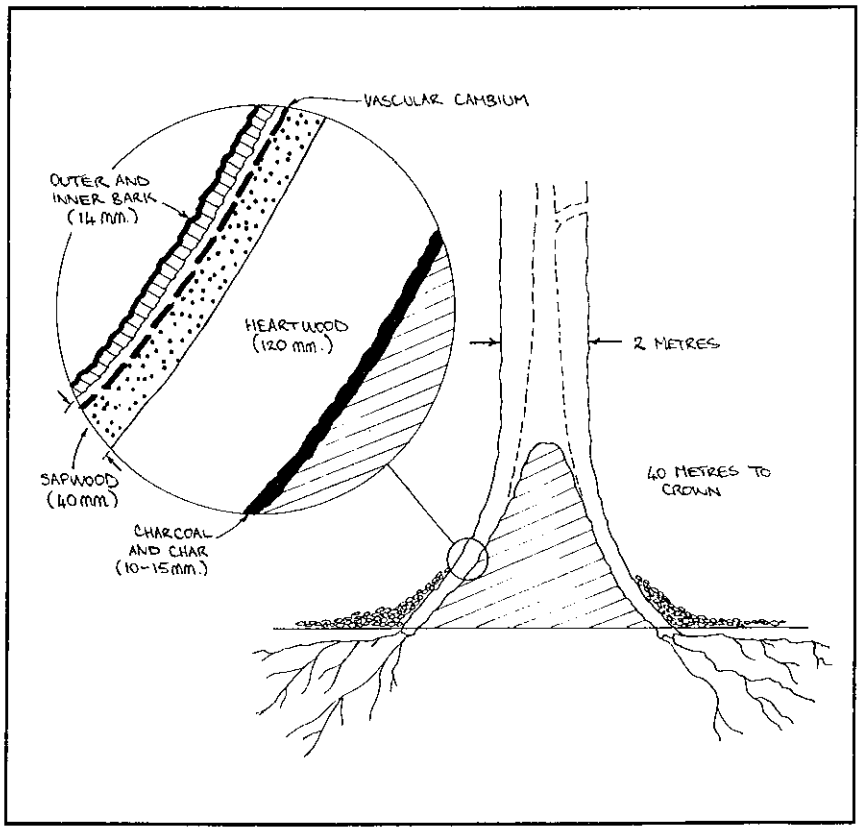
The trial burn at 28 Mile Road in January 1997 was conducted by CALM in liaison with our Association and the NPNCA. It followed representations to the NPNCA and provided much useful data. The work is ongoing with the aim of developing options for conservation after expiry of the current Management Plan in 2002.

1. The prescribed burn of tingle forest south of Twin Creek Road in Giants block. Autumn 1996, 2am.
   Photo: Craig Keesing.
2. Taken just after the prescribed burn front passed this red tingle at Twin Creek Road. Fire has entered through the stem/litter interface and combustion of the core and surrounding structural wood is underway. It will continue to burn for several hours.
   Photo: Tony Pedro.
3. Red tingle (*Eucalyptus jacksonii*).
   Photo: Rod Annear.
4. Common brushtail possum (*Trichosurus vulpecula*)
   Photo: Jiri Lochman.

RED TINGLE HOLLOWBUTTS
Points on Prescribed Burning

Geoff Fernie

The technical literature gives a useful reference point for understanding the process of heat transfer through the bark layers of eucalypts, including red tingle. Hollowbutts however are particularly vulnerable to fire reaching the woody internal face rather than the external rough bark surface of the tree stem. This is leading to a disturbingly high number of tree losses following prescribed burns in our red tingle forest. Observations on contributing factors and management issues are discussed below.



- A retained stem bark thickness of 12 - 15 mm is sufficient to insulate the vascular cambium region from a fatal temperature rise to beyond 50 - 60 degrees C during passage of a prescribed burn.
- Saplings achieve this bark thickness in 5 to 6 years.
- Whilst the time for passage of a fire front is measured in minutes, consequent ignition of the internal charcoal lined surfaces of hollowbutts can produce temperatures of 650 degrees C with a burn period measured in hours.
- Observations suggest that a wood thickness of approximately 150 mm between the burn face and vascular cambian provides insulation against a fatal temperature rise under the prolonged burning periods.

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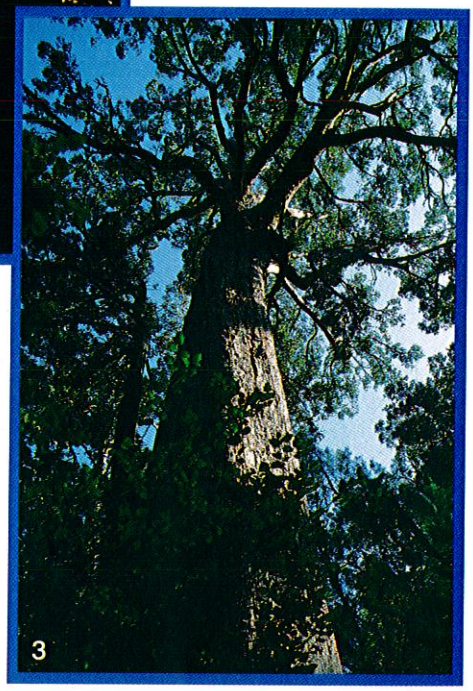

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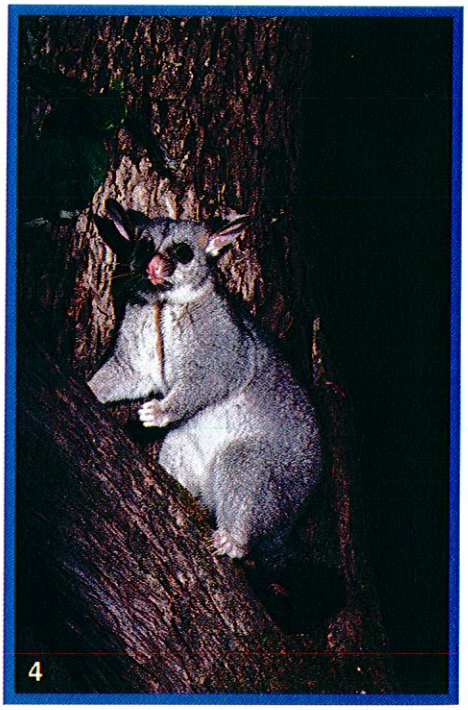

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• However repeated ignition of these internal surfaces at short intervals which do not allow time for restoration of the structural wood thickness by growth will lead to accelerated structural failure in the hollowbutt region.

• Hollowbutting is generally initiated by fungal attack in the core at the base of the tree. Circumstances at the root/humus interface encourage fire to penetrate to the fibrous rot residues leading to loss of cross section on adjacent sound wood. The hollow created may also be breached via dry siding and consequent fire attack through the stem.

• In some trees loss of structural wood through ongoing rot fungi activity in the roots and stem will offset gains due to growth increments between successive fires. Thus even with an extended burn free period such trees may still collapse.

• Exaggerated basal width relative to the intact stem above is promoted by enhanced growth rates in response to fire and fungal damage and by the incorporation of surface roots in the tree shell as it grows outwards. Hollowbutt diameters of 8 metres can result.

• The 1997 trial burn incorporating 60 ha of red tingle forest, prescribed burnt 8 years previously, produced some encouraging results.

• The burn was carried out at a time when the moisture content through the full litter layer was 50%, close to the highest that will still sustain a flame front. Small but important invertebrate habitat patches and unburnt humus were retained. Many hollowbutts did not ignite or were not significantly damaged.

• On the downside 16 hollowbutt tingles still collapsed in the 60 ha area and some 44 other mixed species collapsed in the total burn block. (Under the current management plan 3,500 ha of the 5,000 ha of red tingle forest in the national park will be prescribed burnt.)

• In the case of many of those trees it is a reasonable supposition that earlier fuel reduction burns and particularly the burn conducted 8 years previously, reduced the structural wood area in the hollowbutt region close to the point of collapse. The subsequent growth interval did not allow time for compensating restoration of structural wood before the recent ignition.

• Results of the trial suggest that conducting future burns under high litter profile moisture content will reduce the number of hollowbutt ignitions.

• Seedling response trials in 2 other recently burnt blocks suggest that fruiting and seed set may be more regular than previously thought.

• Caution would indicate that if we are not to rapidly change the structure of the forest, we must as first steps:

a) continue to trial burn under maximum practicable litter moisture content.

b) take more direct action to protect vulnerable hollowbutts (eg. reducing aerated litter locally around the tree leaving an undisturbed annulus of humus immediately adjoining the base.)

c) measure wood thickness loss after a hollowbutt burn together with subsequent wood restoration rates in the hollowbutt cross section.

d) and most importantly seek to develop options for the period beyond 2001 when the current Management Plan expires. One of the aims should be to reduce the area currently designated for 6 to 8 year burn rotations and expand the area currently designated for 10 to 20 year plus rotations.

Over time wild fires involving crown damage and tree collapse will occur in red tingle forest despite fire regimes in place because fuel accumulation rates are so rapid in this high rainfall region. Prescribed burning influences the probability of wild fire and the ability to control it. However within 4 years of such burns the number of days when wild fires can occur begins to become significant. This period corresponds to the time required before obvious visual degradation following a burn is offset by understorey growth and the return of flowering in some key species. The balance between maintenance of red tingle forest structure, biodiversity, visual resource values and fuel reduction objectives will continue to fluctuate with our knowledge of the forest and our experience with wildfire. The current level of co-operation and willingness to examine management options other than the status quo gives hope for the future of this icon of our national park.

Geoff Fernie is a member of the Tingle Consultative Committee reporting to the NPNCA on red tingle fire management. He is an inaugural member of the Association committee and President of the WNNPA (1993-present). ✿

FIRE AND FAUNA

Gordon Friend

In September 1994 Gordon Friend, spoke to members of the Association on the results of his research. At the time Gordon Friend was working in a number of study areas including the Perup Nature Reserve, the Stirling Range National Park and nature reserves at Batalling (near Collie), Durakoppin and Tutanning.

The following is a summary of the lecture.

• There is generally a lack of data on the effect of fire on fauna and flora. In particular, the transitional rainfall zones, ie. the semi-arid areas of our state urgently require a multi-disciplinary, management orientated research programme.

• Animals in the study areas were trapped in pit-fall traps and Elliott traps.

• It is important to have a pre-fire assessment of animals present within an area before it is burnt. By sampling the fauna before a fire and then monitoring both a burnt and a control area after the fire it is possible to understand which fluctuations have been caused by fire.

• No Planned Burn areas are important control areas.

• The frequency and scale of a fire are most important factors for the fauna. Research has shown that the fauna is resilient to a single fire event if the scale of the fire has not been too great. However, the effects of repeated fires are not known.

• The life history of each species predicts its response to fire. There is a different response from a burrowing animal to one that lives in the trees. Fire appears to have a short term effect on the invertebrates, reptiles are little affected, while it may take from 10 to 20 years for the honey possums to get back to their pre-fire numbers.

• It is important that invertebrates be identified to species level as there are many variables which make data interpretation difficult.

• Burning an area often with low intensity fires will cause more problems than a single high-intensity fire. Populations of the honey possum in the Stirling Range will be affected if the burning is more frequent than at 20 year intervals. And the relictual species described by Barbara York Main are extremely sensitive and may require 70 to 100 years between fires.

• It is important to vary the intensity and the season of the fire as much as possible. There is a strong case for autumn burns. A complex study comparing spring and autumn burns has been undertaken in the Stirlings. The best time to burn is March/April. The worst time is September/October.

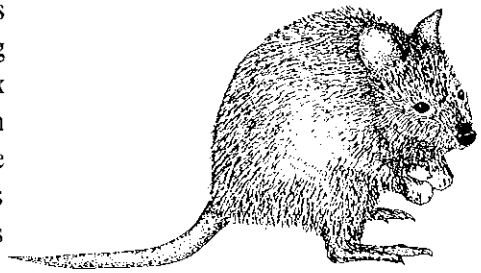
• Spring burns are a disadvantage to many species. In the Tutanning Nature Reserve they have been studying the Red-tailed phascogale. As all males die immediately after breeding this species is very vulnerable to spring time burns.

• The survival of the fauna is dependent on the return of its food base and shelter to the burnt area. If other factors intervene then recolonization may be difficult. The Red-tailed phascogale at Tutanning had problems after the March 1990 fire when their preferred habitat, the regenerating Rock oak casuarina, was seriously defoliated by locusts.

• Recruitment of mobile species from the unburnt areas back into the burnt areas may be quite rapid. In the drier country the fauna seem to be opportunistic and they recolonize quickly after fire. However in the karri forest many species seem to be more fire sensitive and require a longer time before they return.

• In the Collie area there has been a systematic fox baiting programme and the Woylie population has made a dramatic increase. ✿

At the time of his address Gordon Friend was a Principal Research Scientist and Manager of CALM's disturbance ecology research programme in Manjimup.



Quokkas and the 1937 Fire

At a recent gathering of district pioneers from the 1920s and 30s it became evident that quokkas provided an abundant source of protein for struggling settlers. So abundant were they that sections of pasture were fenced off to keep them in for the pot. Opinion was unanimous that after the disastrous 1937 wildfire, quokkas virtually disappeared. But all is not lost, there are regular sightings today and broadscale fox baiting gives cause for optimism.

FIRE AND FLORA OF THE SOUTH COAST

By far our Association's most ambitious project, the November 1994 seminar on Fire and Flora of the South Coast attracted 100 persons to Walpole, including many of the state's foremost botanists and ecologists. Held over two days and concluding in a social dinner this seminar provided a unique forum in which authorities on all aspects of fire and flora could present their findings leaving both lay people and specialists more able to draw conclusions about the burning issue.

The use of prescribed burns moderate in scale, sensitively planned and implemented as part of a wider ranging set of fire management policies, was not in question at the seminar. However the heath/sandplain, low woodland, moist gully and wetland communities distributed throughout the region are subject to systematic, broadscale, short rotation prescribed burning. These communities are commonly recognized as having a high conservation value in terms of species richness, and the occurrence of threatened species and endemic taxa of limited distribution.

Participants submitted in writing, their general conclusions from the technical sessions and discussion periods. Concerns about fire frequency, scale and the absence of appropriate scientific data were common amongst the 45 submissions. Extracts from some of these follow:

• Fire intervals need to be longer than required under present fuel accumulation and hazard reduction regimes if vulnerable components of the flora are to be conserved.

• Generalised conclusions and broadscale policy and management are not appropriate when dealing with such a diverse flora with rapid geographical replacement of species across the landscape.

• It is evident from long-lasting human cultures, local action based on an intimate knowledge of local plants, animals and micro-organisms and their ecology is the most likely approach to yield a lasting human existence in fire prone environments.

• It is unlikely that any particular fire regime will maintain biological diversity at levels where each constituent species retains its original proportion of habitat density. It can be misleading to assess diversity in terms of the mere presence or absence of species in a habitat. Each should be assessed in terms of whether it is "holding its space".

• Far too few studies are being conducted on 'keystone' major vegetation components which 'hold' the ecosystem together and which may well be as sensitive to long term adverse management strategies as vulnerable individual species.

• We will make little progress on the protection of species from fire until we have detailed knowledge of the growth rate, reproduction and recruitment potential of the key vulnerable species we are attempting to protect. Knowledge of patterns of build up of seed stocks, their loss of longevity and amenability to regeneration after a fire event are crucial to understanding the recruitment potential of a species. This coupled to information on seedling survival then allows us to predict whether or not the next generation of a seeder species will equal or exceed in density that of a parent population killed by fire.

• Fire is but one of many stresses to which a species is exposed and its effect cannot be considered in isolation without taking into account factors such as dieback, drought, insect predation and weed invasion post fire. Much more information is needed on the impact of fire on ants, phytophagous insects, birds, fungi and litter decomposition, all of which may influence the health and reproductive capacity of flora.

• Wetlands such as lakes, peat swamps and streams are key features of south coast environments. Aspects of the fire regime can affect hydrological processes which drive these systems. For example the combination of high rainfall and recent extensive fire may lead to a prolonged rise in groundwater bodies. We need to quantify the effects of scale, frequency, season and intensity of fire (both wildfire and prescribed burns) on hydrological processes.

These submission extracts illustrate the difficulty in terms of research time and cost in bringing our level of knowledge up to the standard required for developing best practice prescribed burning strategies in the conservation estate. Nevertheless a number of conclusions specific to fire interval and regeneration influences are summarized. They originate from seminar presentations and associated reference material.

• McCaw, referring to mallee-heath communities in the Stirlings

suggests that the minimum desirable period between fires may be 15 years.

• Monks presented data on *Banksia verticillata* killed by fire, with a 20 year interval needed to build up seed banks.

• Wardell-Johnson referred to the absence of knowledge on management needs of most fire sensitive obligate seeders in the Warren Botanical District with a long juvenile period. These included *B. occidentalis, Grevillea brevicuspis, Hakea lasianthoides. H. oleifolia, Dryandra sessiles, Persoonia microcarpa, Petrophile diversifolia,* and *Isopogon formosus.* He noted research suggesting a desirable fire exclusion period for boronia swamps of 10 - 15 years and referred to work by Baird recommending either planned fire exclusion or a burn rotation in excess of 8 - 13 years for *B. seminuda.*

• Lamont observed that for a range of seeder species of *Proteaceae* the optimal fire frequency is probably 20+ or -5 years. He went on to note that spring fires may be consistent with some conservation objectives but other factors especially recruitment conditions for juveniles after fire are important influences. Canopy seed storing plants already dead before fire (eg from drought, dieback, canker) are ineffective seed sources for recruitment. Weed invasion into small or narrow vegetation remnants is enhanced by fire including prescribed burns, at the expense of native plants.

• Keighery spoke of the 100 endemic species of the Stirlings of which 76% are killed by fire. *Darwinia* require an optimal fire frequency of 20 years.

• Lemson referring to research on *Andersonia* in the Stirlings after a prescribed burn escape noted that the sole known population of *A. axilliflora* is now represented only by fire sensitive juvenile plants. ie the species is now vulnerable to extinction.

• Meney, Nielssen and Dixon discussing their research on many *Restionaceae* and *Epacridaceae* noted that fire sensitive species which do not maintain large persistent seed stores and depend on annual inputs to the soil-seed reserve for post-disturbance recovery, are likely to exhibit very limited reproductive resilience to environmental stress before or after fire, leading to probability of local extinctions. Early spring fires, prior to maturation of the season's seed crop may be especially damaging to obligate seeders. They concluded that previously formulated assumptions regarding the ability of communities to reconstitute populations from seed banks after disturbance (eg. Thompson and Grime. 1979) do not necessarily apply to all species.

• From his studies on northern sandplain vegetation, Wills recommended minimum fire intervals in excess of 8 years, probably 10-12 years.

• Meney, Dixon and Pate highlighted the role of secondary 'catastrophic' disturbances such as drought following fire, on population recovery, leading in the case of *Lepidobolus chaetocephalus* to high levels of flower abortion. Further fires in years 5 or 6 are likely to lead to population extinction, and fires <10 years to critically reduce the population size. This is a fast growing obligate seeder. Its vulnerability emphasizes the potential problems faced by many developing obligate seeders about which very little is known.

• Discussing locally endemic eucalypts in the Walpole-Nornalup area, Wardell-Johnson concluded that on an evolutionary time scale, lower biomass accumulation, greater seasonality and greater frequency of fires are likely in the future. This process is exacerbated by increasing the frequency of fire in the shorter term. Under a regime of more frequent fires *E. calophylla, E. marginata* and *E. guilfoylei* are likely to become dominant while *E. jacksonii* and *E. brevistylis* are likely to become less so. Regeneration success of *E. jacksonii* and *E. brevistylis* is problematical and will require further investigation. Early establishment of these species is especially worthy of consideration. The distribution patterns of these species reflects patterns in distribution of other relictual species. A decline in *E. jacksonii* and *E. brevistylis* has implications for the survival of associated diverse Gondwana fauna. *E. jacksonii* does not flower for at least 30 - 40 years from seed, flowers sporadically and shows limited resprouting ability at the sapling stage. He recommended that considerable areas of tingle forest be excluded from fire.

Endeavours to introduce more adaptive fire management policies into established practices will succeed if change is regarded as a challenge rather than a threat. That change is worthwhile considering is no better illustrated than in the current practice of excluding fire from regenerating karri coupes for periods now approaching 24 years, whilst using areas, like 85% of the Mt Frankland National Park as a burn buffer zone lit up in about 6-7 year rotations. ✿

INVASION OF OUR SOUTH COAST CONSERVATION ESTATE BY *PHYTOPHTHORA CINNAMOMI*

A Long Sad Story Called Dieback

Joanna Young

Driving or walking around our national parks this spring few people realize the impact that *Phytophthora cinnamomi* the Dieback fungus has had already on the flora. Some may wonder why there seem few flowers despite the season, few will realise what was once present. Gradual irreversible changes in vegetation are hard to monitor without laborious recording and a good knowledge of susceptible species. Interpreting changes in the floristics of communities requires an understanding of what species usually grow together on particular soils, constituting different vegetation types.

Phytophthora cinnamomi, the fungus with an exceptional ability to invade the roots of hundreds of plant species of widely different families, was probably introduced to the Western Australian bush not long after settlers arrived with plants to propagate in their gardens. Its localized spread would have been through water and soil. During the 1960's extensive roading was undertaken through forests and parks and this would have resulted in the unwitting spread of the fungus to many coastal heaths, woodlands, forests and swamps. The first comprehensive paper about the disease and the causal organism of so called Jarrah dieback was that by Podger F. D. (1972) *Phytophthora cinnamomi, a cause of lethal disease in indigenous plant communities in Western Australia*. This paper was published in the American journal *Phytopathology*. It is worth noting that Podger did make isolations of *P. cinnamomi* from a range of dying plants in the Walpole area. The fungus was well and truly established in areas like Coalmine Beach and swamps north of the town.

Although I studied and worked on dieback in the northern jarrah forest for 8 years it has taken me time to 'read' and appreciate just what has been lost and what still is at risk. When I see swamps and lowland communities on poor peaty soils supporting little but ti-tree and peppermints, sedges and rushes I always suspect that I am looking at a post *P. cinnamomi* assemblage of plants. None of the plants susceptible to root invasion by this fungus are present. The banksias, the leucopogons, the dryandras, the isopogons etc are few and far between. A few individuals may remain on drier sites or well drained patches, like little islands in the sea of ti-tree. Patches of jarrah may superficially look reasonable but again there may be a paucity of the species which are usually present. *P. cinnamomi* is again the confirmed suspect if close inspection of the sites reveals old remnants of *Banksia grandis* or *Xanthorrhoea*.

One of the reasons it is sometimes difficult to grasp how vast the areas affected by the fungus are, is that frequent fires have resulted in most of the dead plant's remains being burnt. We don't see obvious stands of dead banksias. However the stumps and cores of lost shrubs are usually found down slope from fronts of the fungal invasion.

There are few roads through our parks which aren't now associated with dieback. The road to Coalmine Beach is long infected with a few green patches of banksias left to the north of the road. The Nut Road, Ficifolia Road area has been devastated although the susceptible flora is represented on the uplands. There are special associations near the Nut Road look-out as described in the Management Plan. They will require special care if they are to remain represented in the Walpole-Nornalup National Park. The road to Sandy Beach sees the fungus expressing in the jarrah forest un-

The Hands on Approach

In co-operation with CALM, the Association has undertaken several 'hands on' projects around our national parks. The weed *Dolichos* has been removed from Nornalup's foreshore and several days work by many willing volunteers was required to remove 4 km of old pastoral lease fences in the D'Entrecasteaux National Park. One expedition saw 14 sacks of bottles, broken glass and cans collected from along the shoreline of the Nornalup Inlet. Phosphonate spraying trials to protect selected, vulnerable plant species from the dieback fungus (*Phytophthora cinnamomi*) has been carried out at Poison Hill and another phosphonate spraying project is scheduled for January 1998 in the Ficifolia/Nut Road area. ✿

derstorey, dead *B. grandis* being the indicators here. The swamps of O'Donnell in the Mt. Frankland National Park seem now almost devoid of the susceptible species. And so it goes on.

So to draw on a quote from the *Albany Advertiser* (June 28, 1990) the situation can be summarized as follows: Quoting Malcolm Grant of CALM it was reported "Dieback has enormous implications for the region both in terms of flora and fauna - you can't have an effect on one without affecting the other".

In the past, management options have been limited although large areas of forest were put into quarantine. Now with the publication of the *Review of Dieback in Western Australia* (1996) by Podger, James and Mulcahy there is a change of policy proposed with resources being directed to keeping the fungus out of areas deemed protectable in the long term. Community groups should take the initiative and identify areas which they wish to be involved in protecting. There may well be some people that say 'it is all doomed so let's not worry' but there are things that can be done. The most promising is the use of phosphonate or phosphite, a water soluble chemical which seems to induce a phosphate deficiency as far as the fungus is concerned. This results in stifled invasion of the sprayed host. Plants at risk are sprayed with a very low concentration of the chemical and it breaks down into harmless components. There is still some work to be done to make sure there are no side effects on the plants but it would seem to be 'better alive than dead'.

The best way for people to insure they don't spread the fungus when walking is spraying their boots with weak solution of household bleach eg. White King. In terms of roading or other essential operations in our national parks they should be done under dry soil conditions.

To the future, there are things I'd like to see done. More use of 'disease forecasting' for the protection of special areas. After heavy summer rains when warm moist conditions favour fungal activity, actions which result in the transmission of soil in any way should be minimized. Perhaps more roads should be temporarily closed. The current review of dieback also mentions using fire to encourage germination and re-establishment of susceptible species in areas which have been diseased. A natural selection of resistant species may occur. This may be fine but sufficient time must be given for such individuals to produce optimal amounts of seed for the next generation. Too frequent fire will hasten the decline of some post-fire re-seeders with populations already severely weakened by *P. cinnamomi.*

In conclusion I also hope we do not miss the opportunity to record some of the changes which are occurring to the plant communities of our national parks before it is to late and to at least help initiate processes to help save some of what is left.

Joanna Young is a forest pathologist and Secretary of the WNNPA (1993-present). ✿

SPECIES SUSCEPTIBLE TO DIEBACK DISEASE IN THE WALPOLE-NORNALUP NATIONAL PARK*

1. Species of confirmed high susceptiblity.
   - *Adenanthos obovatus*
   - *Andersonia caerulea*
   - *Astroloma sp.*
   - *Banksia attenuata*
   - *Banksia grandis*
   - *Banksia ilicifolia*
   - *Banksia littoralis*
   - *Banksia quercifolia*
   - *Hypocalymna strictum*
   - *Isopogon axillaris*
   - *Leucopogon distans*
   - *Lysinema ciliatum*
   - *Macrozamia riedlei*
   - *Persoonia longifolia*
   - *Petrophile diversifolia*
   - *Pultenaea reticulata*
   - *Tetratheca setigera*
   - *Sphenotoma gracile*
   - *Xanthorrhoea preissi*
2. Species confirmed to be susceptible.
   - *Agonis hypericifolia*
   - *Beaufortia decussata*
   - *Cosmelia rubra*
   - *Dasypogon bromeliifolius*
   - *Evandra arista*
   - *Eucalyptus marginata*
   - *Eutaxia densifolia*
   - *Hakia varia*
   - *Hibbertia commutata*
   - *Jacksonia aff furcellata*
   - *Latrobea sp*
   - *Leptospermum crassipes*
   - *Melaleuca thymoides*
   - *Lysinema conspicuum*
   - *Persoonia microcarpa*
   - *Petrophile longifolia*
3. Species inferred to be susceptible.
   - *Acacia myrtifolia*
   - *Agonis parviceps*
   - *Andersonia sprengelioides*
   - *Banksia seminuda spp. remanens*
   - *Banksia seminuda spp. seminuda*
   - *Banksia verticillata*
   - *Burtonia conferta*
   - *Dryandra nivea*
   - *Dryandra sessilis*
   - *Franklandia fucifolia*
   - *Hakea ceratophylla*
   - *Hakea prostrata*
   - *Isopogon formosus*
   - *Xanthorrhoea gracilis*

* This list was taken from the *Walpole-Nornalup National Park Resource Document to the Management Plan,* CALM. 1992. pp108-109.

BIRDS OF THE WALPOLE - NORNALUP DISTRICT

This list was compiled by members of the WNNPA and Birds Australia (formally RAOU). If you site any unlisted birds please let either group know.

Emu
Great Crested Grebe
Hoary-headed Grebe
Australasian Grebe

Yellow-nosed Albatross
Fleshy-footed Shearwater
Hutton's Shearwater
Little Shearwater

Australian Pelican
Australasian Gannet
Darter
Pied Cormorant
Little Pied Cormorant
Great Cormorant
Little Black Cormorant

White-faced Heron
Great Egret
Little Egret
Eastern Reef Egret
Nankeen (Rufous) Night Heron
Black Bittern
Sacred Ibis
Straw-necked Ibis

Black Swan
Australian Shelduck
Pacific Black Duck
Grey Teal
Chestnut Teal
Wood (Maned) Duck
Blue-billed Duck
Musk Duck

Osprey
Black-shouldered Kite
Square-tailed Kite
Whistling Kite
Brown Goshawk
Collared Sparrowhawk
White-breasted Sea-Eagle
Wedge-tailed Eagle
Little Eagle
Spotted Harrier
Marsh Harrier
Peregrine Falcon
Australian Hobby
Brown Falcon
Australian (Nankeen) Kestrel

Malleefowl
Stubble Quail
Brown Quail
Painted Button-quail
Buff-banded Rail

Spotless Crake
Dusky Moorhen
Purple Swamphen
Eurasian Coot

Pied Oystercatcher
Sooty Oystercatcher
Hooded Plover
Red-capped Plover
Whimbrel
Common Sandpiper
Bar-tailed Godwit
Red Knot
Red-necked Stint
Curlew Sandpiper
Sanderling

Silver Gull
Pacific Gull
Caspian Tern
Fairy Tern
Crested Tern

Common Bronzewing
Brush Bronzewing

Red-tailed Black-Cockatoo
Carnaby's Black-Cockatoo
Baudin's Black-Cockatoo
Purple-crowned Lorikeet
Red-capped Parrot
Western Rosella
Port Lincoln Ringneck
Elegant Parrot
Rock Parrot

Pallid Cuckoo
Fan-tailed Cuckoo
Horsfield's Bronze-Cuckoo
Shining Bronze-Cuckoo

Southern Boobook
Barking Owl
Barn Owl
Tawny Frogmouth
Australian Owlet-nightjar
Masked Owl

Laughing Kookaburra
Sacred Kingfisher

Welcome Swallow
Tree Martin
Fairy Martin
Richard's Pipit

Black-faced Cuckoo-shrike
White-winged Triller

Scarlet Robin
Red-capped Robin
White-breasted Robin
Western Yellow Robin
Crested Shrike-tit
Golden Whistler
Rufous Whistler
Grey Shrike-thrush
Restless Flycatcher
Grey Fantail
Willie Wagtail

White-browed Babbler

Splendid Fairy-wren
Red-winged Fairy-wren
Southern Emu-wren
White-browed Scrubwren
Shy Hylacola
Weebill
Western Gerygone
Inland Thornbill
Western Thornbill
Yellow-rumped Thornbill

Varied Sittella
Rufous Treecreeper

Red Wattlebird
Little Wattlebird
Singing Honeyeater
White-naped Honeyeater
Brown Honeyeater
New Holland Honeyeater
White-cheeked Honeyeater
Tawney-crowned Honeyeater
Western Spinebill

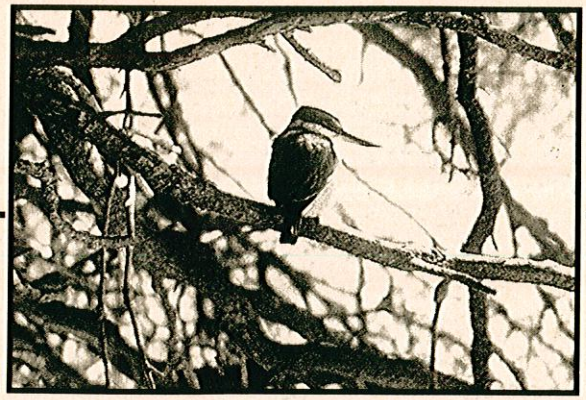
Spotted Pardalote
Striated Pardalote

Silvereye

Red-eared Firetail

Australian Magpie-lark
Dusky Woodswallow

Grey Butcherbird
Australian Magpie
Grey Currawong
Australian Raven



Sacred Kingfisher. *Photo: Craig Keesing.*

Acknowledgement: Thanks to Katrina Syme and CALM for line drawings.