No. 84
JANUARY 1986

The Tasmanian Naturalist

Registered by Australia Post – Publication No. TBH0495
Postal Address: G.P.O. Box 68A, Hobart, 7001
Editor: D.A. Ratkowsky Annual Subscription: $8.00

SHARING OF SMALL HOLLOW BY ROOSTING BATS AND NESTING FORTY-SPOTTED PARDALOTES

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The synchronous use of one hollow by two or more species may not be uncommon (e.g. Golding (1979), Habitat 7 (6): 3-6), though little information has been collected. During a survey of breeding Forty-spotted Pardalotes *(Pardalotus quadragintus)* on North Bruny Island in spring 1983, I recorded an instance of two bats roosting for at least five days on the inside wall of a stump used by nesting pardalotes. The bats were probably Gould's Wattled Bat *(Chalinolobus gouldii)* based on body and ear size.

The pardalote nest was placed at ground level at the base of a narrow (diameter 8cm) vertical shaft running the entire height (60 cm) of the stump. The bats were roosting together about 30cm above the nest. I first located the nest on 30 September and checked the hollow on 2, 4, 6, 7, 8 and 10 October 1983, and on eleven days subsequently. At least three young pardalotes were present from 2 October onwards. The two bats were recorded in about the same position on all visits from 4 to 8 October. Because of the position of the bats with respect to the nest, and the narrowness of the hollow, the pardalotes must have had to clamber over (or at least contact) the bats during every visit to the nest. The frequency of such visits varied between 12 and 48 per hour (based on four 10-minute counts). The young pardalotes were frequently vociferous. Perhaps not surprisingly the bats appeared quite awake and somewhat active whenever I checked the hollow. I noticed no reaction by the adult pardalotes to the presence of the bats, and they succeeded in raising all young. The bats disappeared after 8 October and I did not see them again.

NOTES ON THE WOMBAT

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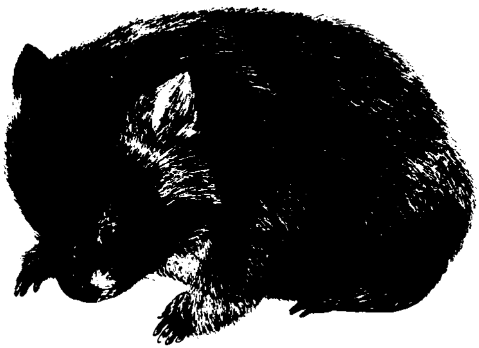
The Tasmanian Wombat is generally regarded as a subspecies of the Common Wombat, *Vombatus ursinus,* which also occurs in southeastern mainland Australia. Its primary habitat is forested areas but also includes woodland, coastal scrub and heathland. This note reports two apparently unusual observations from the Asbestos Range National Park on the north coast of Tasmania west of the Tamar Estuary.

Although primarily nocturnal, at Asbestos Range large numbers of wombats were observed grazing over several hours during the middle of a cloudless day in June 1985. Substantial areas of the park are derelict farmland and it was on these areas rather than adjacent coastal heath or scrub habitats that diurnal wombat activity was observed. From an adjacent hill, Archers Knob, some 70 wombats were counted with field glasses grazing on an area of pasture of about 40 ha. Distances between individuals were subjectively assessed to be regular. Most individuals seemed unperturbed by walking to about 30m from them and careful movements often allowed much closer approach.

Of more than 100 wombats observed in full daylight, only one was noticeable smaller than adult size. Upon approach it took shelter under a log from where it was caught by hand, proving to be a young male of about 3kg bodyweight. Adult weight of Tasmanian wombats is about 23kg (Green, 1973). This individual commenced a distress call, a high-pitched squeal repeated with each exhalation of breath. An adult 15-20m away then fixed on the sound and charged. The juvenile was immediately released and the adult then deviated in its course to investigate the whereabouts of the juvenile in nearby scrub where it had retreated.

References

Green, R.H. 1973. *The Mammals of Tasmania.* The Author, Launceston.



COMMON WOMBAT

Drawing by Jane Burrell, used with permission of the Tasmanian Museum and Art Gallery.

THE NATURE OF LICHENS

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Although it is now generally recognised that a lichen is not a single plant, but a highly complex association of an alga and a fungus, the true nature of lichens is still not completely understood. The Swiss scientist S. Schwendener perceived that lichens were associations of fungi and algae, and stated his theory in an address to the Swiss Naturalist's Club in 1867. He believed that lichens consisted of fungi parasitising algae. This theory did not receive ready acceptance, possibly because lichens had been considered to be single plants and had been classified as such since the time of Linnaeus. Another factor may have been the scientific establishment's innate conservatism and its resistance to the acceptance of new ideas. Also, Schwendener's theory did not have any empirical support, as his attempts at synthesising lichens did not meet with more than limited success. Although experiments at synthesis did not settle the matter, O. Treboux (after whom the algal genus *Trebouxia* is named) in 1912 separated the algal component from lichens and found that they are similar to free-living algae. With this important experimental finding came a general acceptance that lichens were a fungal/algal relationship.

The association is said to be symbiotic (that is, the components live together) but there were influential botanists who believed that the association is one of mutualism, in which both the algal and fungal partners benefit. They promulgated the notion that the algal component received moisture, shelter and possibly minerals from the fungus in exchange for the provision of carbohydrates and other nutrients by the alga, as the fungus, not possessing chlorophyll, is unable to undergo photosynthesis. Some proponents of the theory went so far as to suggest that the association was an idyllic partnership.

More recent studies cast doubt upon this concept. Experiments carried out by Vernon Ahmadjian, and described by him in the March 1982 issue of Natural History, pp. 30-36, indicate that the idea of mutualism is wrong. He has succeeded in synthesising lichens and has concluded that the fungi parasitise the algae, but that the parasitism is a controlled process. In 1979 he discovered that thin strips of newly cleaved mica make an ideal substrate for growth and that using conditions of high relative humidity and a medium that was not too rich in nutrients, he succeeded in making lichenised unions between algae and fungi. He tried to answer certain questions such as whether one lichen fungus can form unions with different species of algae, whether one alga could serve as symbiont to different fungi, and whether previously unknown hybrid lichens could be created in the laboratory. Working first with *Cladonia cristatella*, he separated the fungal component from its normal algal component *Trebouxia erici*, and mixed the fungus with a variety of algal species of the same genus and of related genera, some of which were known to form lichens with other fungal components, and some of which were not known to lichenise in nature. The result was that the fungal component lichenised five species of *Trebouxia* but not four other species of that genus, killing three of them. It did not lichenise any of twelve species of *Pseudotrebouxia* or with species of the same algal order as *Trebouxia* which are not known to lichenise in nature.

All the initial reactions were the same. The algal cells became covered with fungal filaments called hyphae, forming a strangling network around the cells. The most susceptible species of algae were killed by this process. Other more compatible species managed to reproduce fast enough to avoid being killed off completely, although some individuals cells of even these compatible species were killed, but not as quickly as the cells of incompatible species. It appears that lichens are made up of algae parasitised by fungi, but the parasitism is a controlled process and the algal cells are in different stages of resistance. Thus, the idea put forward by Schwendener more than a century ago has been confirmed by this recent experimental evidence. Ahmadjian, in the Natural History article mentioned earlier, goes on to discuss the role that may be played by toxic compounds to stop or slow the growth of the fungus.

Lichens are extraordinarily variable plants. Each species has a distinctive shape, which appears to be determined by the fungal partner, because some fungi lichenise more than one species of alga in nature. The classification of lichens is therefore based on the fungal partner, which produces fruiting bodies in many species. The fruiting bodies produce spores, and after dispersal the germinating spore must rapidly come into contact with suitable algal cells or else it will die without lichenisation taking place. Not all lichens reproduce by this means, as some species have never been known to produce fruiting bodies. However, many species, including some of those that also reproduce by fruiting, propagate vegetatively by means of soredia and isidia, which are fragments of the thallus (lichen body) which can break off and be carried away by animals, wind or rain. If they come into contact with a suitable substrate, they may develop into a complete lichen.

The lichen thallus is a very variable structure. It often consists of both an upper or lower cortex of compacted fungal hyphae which may be cellular, but in most of the crustose species, which tightly adhere to the substrate of rock or bark, the lower cortex doesn't exist. Beneath the upper cortex is the algal layer, and between that and the lower cortex or substrate is a medulla composed of relatively loosely woven hyphae enveloping the algal cells. Within this broad description is a wide range of variation. For example, in the fruticose lichens, which are pendulous (hanging) or which arise erect from the substrate, there is often a holdfast which attaches the lichen to the substrate. Species of *Usnea* (Old man's beard) have a tough central core.

A fascinating aspect of lichens is their ability to produce a series of unique acids, chemical compounds that are not known to occur in any other natural group. These lichenic acids are useful aids in identifying lichen species. Some of the chemical tests are very simple to carry out, requiring readily available substances such as potassium hydroxide and household bleaching agents. Some lichens, which morphologically appear to be identical, can be distinguished on the basis of their chemistry. Although few taxonomists would question the concept of "chemical races" based on the compounds that two otherwise indistinguishable specimens contain, the concept of "chemical species" is highly controversial. To illustrate the problem, consider two cosmopolitan species of *Cladonia*, *C. chlorophaea* and *C. merochlorophaea*, which are distinguished by their different chemistry. However, *C. merochlorophaea* is itself composed of two chemodemes (groups of chemically differentiated individuals of a species) which have an identical morphology! Thus, there are many aspects of lichen taxonomy yet to be elucidated. Field naturalists can play a large part in contributing towards the discovery and understanding of different lichen forms.

THE GREAT FROST 1837

[Editor's note. The following is part of an account by J.E. Calder of the country between Hamilton and Frenchmans Cap that was published in the Hobart Town Courier, 21 September 1850. It should still be of interest to readers today as it indicates the magnitude of natural disasters that can occur within Tasmania in the not-too-distant past. This portion of the account begins when the author is standing on the Dee Bridge, overlooking the river that is formed by the overflow of Lake Echo.]

It is at this part of the journey that we catch the first sight of the effects of the vigorous winter of 1837, a season of extraordinary severity and which in a few weeks struck with death the forests throughout the *valleys* of well near all the highlands in this part of Tasmania. Here, however, it ceased its ravages, and its withering march from the westward was stayed. The storm moderated and when it reached this river it seems to have wholly died away, but not before its task was finished, its work of demolition fully completed. For the destruction of the forests of all the *lowlands* of this extensive district could not have been more perfectly accomplished if even a simoon had passed over them. This extraordinary season destroyed the timber of almost every *valley* on the vast plateau lying between this quarter and the mountains terminating at the verge of the Westbury and Norfolk Plains districts. The havoc has been indeed tremendous but wholly incalculable.

It is impossible to witness the effects of this winter without emotion and the traveller unaccustomed to such a picture of desolation is startled at the amazing scene of ruin which now presents itself. The bush is one interminable mass of dead trees. *Except on the hilltops* everything around him is dead. Whichever way he looks he sees hardly anything but dead forests, one apparently unending expanse of dead trees. The farther he advances beyond the Dee, the more perfect has been the destruction. About this river, where the tempest seems to have slackened, nearly half the trees have perished or are only now just recovering from the shock they received 13 years ago. But it is around the incipient town of Marlborough (Bronte) the winter seems to have put forth its full strength, for here *(the hilltops always excepted)* the annihilation of life is almost universal as for miles every tree on the lower lands has died. It is a very extraordinary fact that within the last year or two about four of the trees in this township have put forth leaves after an apparent suspension of vitality of 10 or 11 years duration.

A person writing of the districts I have taken to describe will not be accused of digressing in pausing to attempt the investigation of the cause which led to the demolition of the forests here. The subject is interesting and that task can never be considered an unprofitable one which has for its object the exposition of the truth and if possible some correction of the vague hypotheses by which some have endeavoured to account for their decay, I believe more with the view of establishing new theories than of coming to the truth. According to some this was occasioned by disease, to others by lightning, while another class ascribe the calamity to extensive bush fires. But these persons are either ignorant of the true cause or they belong to that class of man who will never adopt a commonsense view of anything whatever.

I was a traveller in these districts as long ago as 1835. At that time the trees were everywhere fresh and vigorous. In the beginnings of 1838 I passed this way again only a few months after the destruction of these forests had been effected. The ground was then covered with dead leaves (the effect of the simultaneous decay of the millions of trees which had just perished) and the bark was hanging in shreds from every bough. A most severe winter had occurred not long before, and a deep snow had fallen which lay on the ground for many weeks, by which (the grasses excepted) vegetation on the lower lands was perfectly annihilated. The kangaroos which swarmed here in 1835 were all but extinguished and one of a party of men who was up here then assured me that by taking advantage of the helpless condition to which the poor animals were reduced by hunger and long-conditioned cold he and some others killed in one afternoon no less than 67. Judging from the quantities of their bones which I found scattered everywhere (I am speaking of 1938), they must have died by thousands.

If we did not know that the destruction of the trees took place with the occurrence of this terrible winter, an examination of the district would lead us to infer that *cold* was the agent, from the simple fact that *on the top of every hill and ridge the trees never died.* This is to be seen everywhere, even around Marlborough, about which place the winter seems to have poured the full storm of its strength. It is not on *one hilltop alone* that the trees are still green and vigorous but on every hill throughout the district. If, then, fire were really the agent, how came the trees to have escaped death in these situations and that invariably? Are its effects less destructive on the hills than elsewhere? The answer of everyone will be certainly not. Again do bush fires destroy the forests or even seriously injure them? We see the contrary in 500 cases every summer. If such were the case, there ought not to be a tree left us in all Tasmania. But the notion is absurd. Moreover, the trees in these districts *do not* exhibit any extraordinary marks of fire as would certainly be the case had they been destroyed by it. But I believe we might as well impute the devastation to the Mosaic deluge as to either fire or disease.

BOOK REVIEW

Arid Australia

Edited by H.G. Cogger and E.E. Cameron
Published by Australian Museum, Sydney, 1984, 338 pp.
Paper cover and photoreduced typescript.
Reviewed by Peter B. McQuillan

Arid and semiarid zones collectively cover almost 80% of Australia but are poorly studied. Sadly, these fragile environments have suffered much degradation through erosion and overgrazing, and have lost an alarming number of native animals since the arrival of European man.

This small book comprises 25 articles and summaries presented at a 1977 symposium aimed at promoting a better understanding of arid Australia. Chapters range in length from 1 to 48 pages and cover aspects including geology, ecology and the physiology and distributions of plants and animals in a manner varying from superficial to comprehensive. While the format is designed to reduce costs, it is unfortunate that some figures are too reduced in size or have overlong captions in tiny print. Some photos are poorly reproduced but typographical errors are relatively few.

In a well-illustrated open chapter, P.G. Quilty reviews the geological and tectonic history of Australia between 225 and 1.85 million years ago. This provides an historical background to the information on our arid zone and its plants and animals. The evolution of aridity is then considered in detail by M.A.J. Williams who summarises the evidence from fossil sea temperatures, prehistoric lake levels and glacial data to reconstruct past climates. It appears that adaptation to aridity by Australian biota has a history of 40 million years, but especially the extreme climatic fluctuations of the last 2½ million years has seen cycles of evolution and extinction as witnessed by the rise and fall of the giant marsupials.

The gross vegetation formations are briefly considered by J.S. Beard, and spinifex in particular by S.W. Jacobs. The reptile fauna is lucidly analysed by H.G. Cogger who notes the presence of an unusually large number of species of lizards and relatively few snakes compared to the reptile fauna of other arid regions of the world. P.J.M. and P. Greenslade note some features of the ant and springtail fauna in an article with the rather misleadingly comprehensive title of "The soil surface insects...".

Particulary hard-going for the general biologist is the lengthy review by H. Heatwole which summarises, with few Australian examples, the known physiological adaptions of arid zone amphibians of the entire world. While a valuable piece of work, it is probably misplaced in a book with this title.

That ubiquitous agent of destruction, the rabbit, is the subject of an interesting chapter by D.H. Wood, and the interactions between native and introduced grass feeding mammals (e.g. kangaroos versus cattle) are comprehensively discussed in two later chapters.

In summary, articles vary from lucid accounts easily understood by people with a general interest in biology to highly technical reports replete with mathematics understandable only to those "in the know". Several half-page abstracts of articles are, I believe, unsuitable in a publication of this kind.

Due to its origins, the book lacks a cohesive style. As a summary of a symposium it is adequate, representing as it does a diversity of views and subjects by a range of authors. For those participants it forms a useful souvenir and it will also take its place in reference libraries. However, as a semi-popular book aimed at even a moderately-informed public, it must be judged as less than a success, handicapped by uneven treatment of its subjects, lack of a theme and missing an index. The long delay (7 years!) between the symposium and publication means that some information is out of date or more recent accounts are available elsewhere. Nevertheless, it sets a desirable trend of bringing symposia proceedings to a wider audience.

While it is an interesting book to dabble in, as there is something of interest to most naturalists, I cannot recommend it as a good buy, but do not let that deter you from borrowing a copy from your local library.

BENNETT'S WALLABY

Drawing by Jane Burrell, used with permission of the Tasmanian Museum and Art Gallery.

EASTERN NATIVE CAT

Drawing by Jane Burrell, used with permission of the Tasmanian Museum and Art Gallery.