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# THE TASMANIAN NATURALIST

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# DISTRIBUTION AND ECOLOGY OF THE CENTIPEDE *CRATEROSTIGMUS TASMANIANUS* POCOCK, 1902 (CHILOPODA: CRATEROSTIGMOMORPHA: CRATEROSTIGMIDAE) IN TASMANIA

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**Abstract.** *Craterostigmus tasmanianus* Pocock, 1902 is widely distributed in native forest and woodland in Tasmania from sea level to at least 1300 m. It has not been recorded from moorland, grassland or heath, and in the drier portions of its range is restricted to permanently moist microsites. In western Tasmania *C. tasmanianus* is common and tolerates considerable habitat disturbance. Females brood eggs and young between September and April and clutch sizes of 44-77 eggs have been recorded. In its preferred microhabitats (rotting logs, moist leaf litter) *C. tasmanianus* may compete for prey with other species of centipedes and other invertebrate predators of similar size and cryptic habit.

## INTRODUCTION

*Craterostigmus tasmanianus* Pocock, 1902 (Fig. 1) is an unusual centipede which is usually placed in the monotypic order Craterostigmomorpha (Lewis 1981, Shear and Bonamo 1988, Dohle 1990). The only published information on the natural history of this species consists of brief notes in Manton (1965) and in a popular work by the present author (Mesibov 1986). In this paper I summarise what is currently known about the distribution and ecology of *C. tasmanianus* in Tasmania.

## METHODS

Locality records for *C. tasmanianus* from the Queen Victoria Museum and Art Gallery (QVMAG), the Tasmanian Museum and Art Gallery, Forestry Tasmania, the Zoology Department of the University of Tasmania, the Australian National Insect Collection, the Museum of Victoria and the author's field notes have been combined in a database which currently (24 October 1994) contains 227 records. In all but a few cases the localities have been specified as a map grid reference with an accuracy in plan of ±100 m. Only eight of the records predate 1970, and the author is responsible for 135 (67%) of the collection records and all of the 25 sighting records in the database. The *C. tasmanianus* database is maintained by

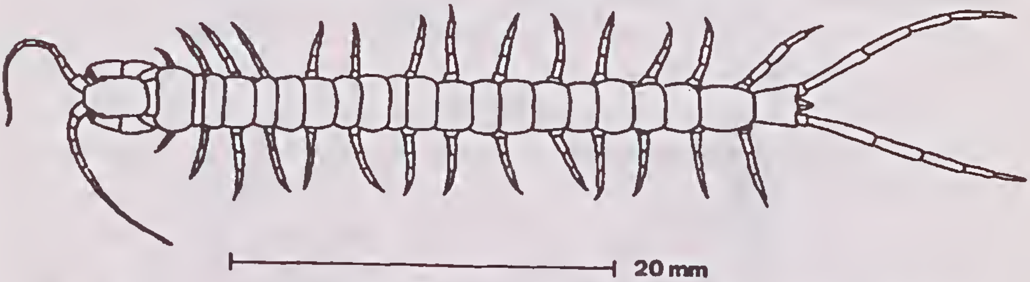


**Fig. 1.** *Craterostigmus tasmanianus* (adult). Note the 15 pairs of legs and (apparently) 21 body segments. Colour is greenish-brown with a red-brown head.

the author and additional records are welcome; a copy is held at QVMAG with restricted access.

## DISTRIBUTION

*C. tasmanianus* occurs on the main island of Tasmania and several nearby islands (Fig. 2), but it has not yet been found on any of the islands in Bass Strait, nor on the Australian mainland. It ranges from sea level to at least 1200 m on the Central Plateau and at least 1300 m in the northeast highlands. At most localities *C. tasmanianus* is active throughout the year, but snow cover and freezing conditions may limit its activity at higher elevations in winter.

The type locality of *C. tasmanianus* is the summit of Mt. Rumney, near Hobart (Pocock 1902). It was collected here by the visiting New Zealand naturalist G.M. Thomson, probably in January 1892 (Thomson, 1893). Roading and residential development have substantially degraded the native forest on Mt. Rumney over the past century, and the summit has been cleared for a communications facility. A recent search by the author failed to yield *C. tasmanianus* at the type locality.

## HABITAT

Throughout its range *C. tasmanianus* is apparently restricted to native forest and woodland. It has not been found in moorland, grassland or heath, even where *C. tasmanianus* occurs abundantly in adjoining forest. The species has been collected in closed *Nothofagus* rainforest, tall open wet eucalypt forest, open dry eucalypt forest, subalpine woodland and closed riparian and swamp forest (*Melaleuca* and *Leptospermum* forest). *C. tasmanianus* is known to persist in wet eucalypt areas in northwest Tasmania which have been clearfelled and burned prior to reafforestation with native species, and it can be abundant in the dense regrowth forests which develop 10-15 years after such treatment. However, *C. tasmanianus* has not been recorded from plantations of *Pinus radiata* or *Eucalyptus nitens*.

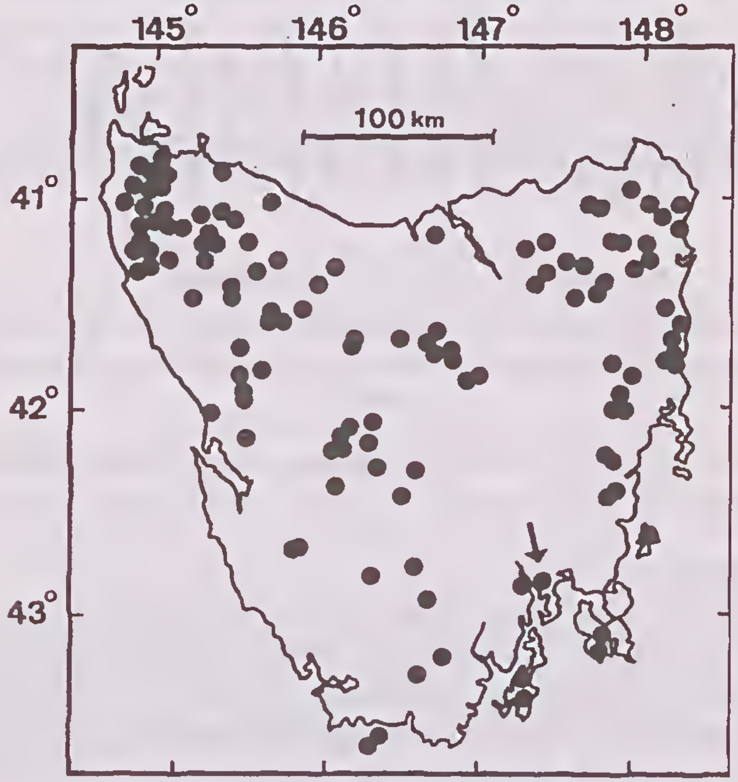


Fig. 2. Distribution of *C. tasmanianus* in Tasmania. Closely adjacent localities are marked with a single dot. Arrow indicates type locality, Mt. Rumney.

In the drier, eastern portion of its range, *C. tasmanianus* can only be found in more or less permanently moist microhabitats, such as rotting logs lying close to flowlines, and piles of rock (Quaternary talus) on south and southeast-facing slopes. In western Tasmania the species is well dispersed through the forested landscape. Preferred microhabitats are well-rotted logs, deep humus and moist leaf litter. Juveniles can be locally abundant in deep leaf litter, while older individuals typically shelter on the surface of the soil under fallen logs and tree limbs. My impression is that *C. tasmanianus* populations in the west are larger on relatively fertile soils (e.g. those derived from Tertiary basalt) than on relatively poor substrates (e.g. organic soils over Precambrian sediments) in the same area, although the forest cover over the two ground types may be equally dense. The highest mean density recorded for an area is one specimen per 12 $m^2$ obtained by hand-collecting in *Nothofagus* forest on basaltic clay soil (Mesibov 1993).

## BIOLOGY

'The life history of *Craterostigmus* is incompletely known' (Manton 1965, p. 312). This statement is still true, although a few details are available from collecting records. Females in northwest Tasmania have been found guarding egg masses in late September and hatchlings in April, suggesting that half the year may be occupied with brood care. As reported by Manton (1965) from observations by the late Prof. V.V. Hickman, the usual brooding chamber is a cavity in a moist, rotting log. Five females collected in 1990 were brooding 44, 54, 57, 69 and 77 eggs, respectively. Fully mature *C. tasmanianus* can reach 50 mm in length, but brooding females only 30mm long have been collected. Early juveniles, with 12 pairs of legs (c.f. 15 pairs in the adult), disperse in the winter months and can be found in leaf litter well away from rotting logs. Database records show that older juveniles and mature individuals have been collected in all months of the year, despite the report of Manton (1965) that *C. tasmanianus* is difficult to find outside the brooding period.

Manton (1965) judged from anatomical features and food preferences in captivity that *C. tasmanianus* might be a specialist feeder on termites and other 'burrowing' insects. The natural prey of *C. tasmanianus* is still not known, but no close association of this species with termite colonies has been observed in the field. Potential and abundant prey in the preferred microhabitats of *C. tasmanianus* include terrestrial amphipods and isopods, millipedes, fly larvae, mites, collembolans and adults and larvae of beetles. The author has maintained *C. tasmanianus* in captivity on a diet of flies, crickets and terrestrial isopods.

*C. tasmanianus* shares its microhabitats with a range of other invertebrate predators of similar size: terrestrial triclad flatworms, the land nemertine *Argonemertes australiensis* (Dendy, 1889), onychophorans, carabid beetles and other centipedes. The latter include anopsobiine and henicopine Lithobiomorpha, cryptopid and scolopendrid Scolopendromorpha and at least two genera of large Geophilomorpha (Mesibov 1986). In the wetter forests of northeast Tasmania, as many as 10 centipede species can be found at a single site, including *C. tasmanianus*, and an investigation of interspecific competition and niche separation would make a rewarding study. As *C. tasmanianus* matures it progressively 'outgrows' all potential centipede competitors except the scolopendrine *Cormocephalus westwoodi* (Newport, 1844), which can reach 60 mm in length in Tasmania. Near Nunamara and St. Marys in northeast Tasmania I have found the two species sheltering within a few centimetres of each other under stones and in the 'skirt' of moist litter around the base of large eucalypt trees. *Cormocephalus* was also collected at the type locality of *C. tasmanianus* in 1892 (see under 'Distribution', above), according to the specimen register of the Natural History Museum in London where the types were lodged (Dr. P. Hillyard, pers. comm.).

## DISCUSSION

Archey (1917) reported the occurrence of a *Craterostigmus* species in South

Island, New Zealand, where it was widespread and locally common. He identified this centipede as C. *tasmanianus* Pocock 1902. However, the late R.E. Crabill examined Tasmanian and New Zealand specimens and concluded that they represented distinct species (R.E. Crabill, pers. comm.). A manuscript describing the New Zealand species was prepared but has not been published. If the New Zealand form is indeed distinct, then C. *tasmanianus* is a Tasmanian endemic.

The occurrence of *Craterostigmus* in only two relatively small, well-separated areas of Australasia, together with phylogenetic evidence that a craterostigmomorph ancestor may have been extant in the middle Devonian (Shear and Bonamo 1988), suggests that the genus was formerly widespread and that its present distribution is relictual. Nevertheless, within its present day range *Craterostigmus* in Tasmania is an ecologically tolerant species, and its presence in parts of the Central Plateau which were repeatedly glaciated in the Pleistocene (Kiernan 1990) demonstrates that it is an effective coloniser of 'new country'. In Tasmania the principal factor limiting its distribution seems to be the availability of moist microhabitats in native forest and woodland. For this reason it is threatened in the drier portions of its range by frequent wildfires and overzealous fuel reduction burning in native forest. However, over most of its range, which includes the largest of the forested National Parks and other reserves in Tasmania, C. *tasmanianus* is common, often locally abundant, and evidently not threatened by land management practices other than forest clearing for agriculture or plantations.

## ACKNOWLEDGEMENTS

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# NEW ZEALAND'S WILDLIFE CRISIS: LESSONS FOR TASMANIA

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## INTRODUCTION

Tasmania and New Zealand are close geograpical neighbours but the evolution and recent history of their faunas are remarkably different. In 1994 I spent four months in New Zealand reviewing conservation programs for threatened species. In this paper I will outline some of the conservation dilemmas facing New Zealand and comment on the lessons Tasmania can learn from their experience.

## EVOLUTION OF THE NEW ZEALAND FAUNA

Compared to Australia and many other parts of the world, New Zealand has a low faunal diversity. Birds comprise by far the majority of New Zealand's native terrestrial vertebrates with mammals represented by only two species of bats. However, what makes New Zealand distinct is its amazingly high degree of endemicity, with more than 75% of native birds, approximately 90% of insects and 100% of amphibians and reptiles occurring nowhere else in the world (Department of Conservation 1994a).

This low diversity yet high primary endemism resulted from the breaking away of the ancestral New Zealand from southeastern Gondwana during the Cretaceous period (110 - 80 million years ago). The absence of a land bridge connecting New Zealand to other continents led to a proportionally high colonisation by birds (which were able to cross the water barrier) and to the total absence of later evolutionary forms such as terrestrial mammals, particularly mammalian predators (Enting and Molloy 1982).

This isolation allowed many relic and ancient species to persist to the present day. Examples include the tuatara *Sphenodon punctatus*, the yellow-eyed penguin *Megadyptes antipodes* and the kiwi *Apteryx sp*. Some species, such as the saddleback *Philesturnus carunculatus*, the kokako *Callaeas cinerea*, and New Zealand's rock and bush wrens including the diminutive rifleman *Acanthisitta chloris*, the piopio *Turnagra capensis* (New Zealand's native thrush), and the beautiful wattlebirds like huia *Heteralocha acutirostris* (now extinct), have changed very little since the Tertiary period (40 - 65 million years ago). The absence of mammal species enabled many birds to develop spectacularly large body sizes and exploit vacant mammalian niches. For example, the moas (Order Dinornithiformes) (now extinct) , the kakapo *Stringops habroptilus*, the laughing owl *Sceloglaux albifacies* (now extinct), the giant land snails *Powelliphanta* sp., centipedes *Cormocephalus* sp. and the giant wetas *Deinacrida* sp. (often described as dinosaur insects (Mead 1990)), are all the largest of their kind in the world.

Offshore islands which became separated from mainland New Zealand over 10 000 years ago have also developed a high degree of local endemism. Species such as the Campbell Island teal *Anas aucklandica nesiotis*, Middle Island tusked weta (undescribed), Kermadec koromiko *Hebe breviracemosa*, Mokohinau stag beetle *Dorcus ithaginis* and a suite of species on the Chatham Islands like the black robin *Petroica traversi*, warbler *Gerygone albofrontata* and taiko *Pterodroma magentae*, maintained discrete and limited distributions.

## DRAMATIC DECLINES

In less than 1000 years of Polynesian and European colonisation, massive alterations to New Zealand's natural environment have taken place. Since human occupation 90% of all wetlands have been drained or degraded, indigenous forests which once covered 86% of New Zealand now cover only 23% and only 10% of the tussock grasslands which existed in 1840 remain today (Department of Conservation 1993). Unfortunately, it's an all too familiar scenario which has been replicated over most parts of the world.

This impact has led to the extinction of over 55 species and subspecies of animals, including 44 species of birds (12 of which were moa) from 32 genera and 6 families (Holdaway 1989). This extinction event is considered one of the last faunal collapses of Holocene time and is equivalent to those which occurred in Madagascar and Hawaii (Holdaway 1989). There are currently 443 species of plants and animals on the Department of Conservation's threatened list (Molloy and Davis 1994). Fossil evidence shows that many of these threatened species, such as the Leiopelmatid frogs, skinks and geckos, were once widespread but are now either totally confined to offshore islands or small remnant patches of habitat on the mainland. The number of threatened taxa are given in Table 1. Virtually all of the species in the three highest priority categories are endemic.

## DESTRUCTION BY INTRODUCED SPECIES

The extinction of New Zealand's wildlife has been caused by several major events. Firstly, uncontrolled hunting by Polynesian settlers of many native and vulnerable species of moa, swan, flightless geese and rail. This in turn depleted food stocks for avian predators such as Haast's eagle (now extinct) *Harpagornis moorei*. Secondly, extinctions caused by the dramatic loss of habitat due to clearing of native forest and grasslands and the practice of widespread firing, for example throughout the Canterbury Plains. Finally, the introduction of a large

**Table 1. Numbers of native taxa (species and subspecies) and the approximate proportion of taxonomic groups that are considered threatened in New Zealand (from Molloy and Davis 1994).**

| Taxonomic Group | Category A Highest Priority | Category B Second Priority | Category C Third Priority | Threatened in NZ, secure elsewhere | TOTAL | % of group in categories A to C |
|---|---|---|---|---|---|---|
| **PLANTS** | **42** | **91** | **26** | **27** | **186** | **6** |
| Non-vascular | 6 | 23 | 5 | - | 34 | 4 |
| Vascular | 36 | 68 | 21 | 27 | 152 | 7 |
| **INVERTEBRATES** | **26** | **52** | **20** | **-** | **98** | **<0.1%** |
| **VERTEBRATES** | **30** | **71** | **45** | **13** | **159** | **51** |
| Fish | 1 | 4 | 5 | - | 10 | 33 |
| Frogs | 1 | 3 | 0 | - | 4 | 100 |
| Reptiles | 9 | 15 | 4 | - | 28 | 57 |
| Birds | 16 | 46 | 36 | 11 | 109 | 59 |
| Bats | 3 | 1 | 0 | - | 4 | 100 |
| Marine mammals | 0 | 2 | 0 | 2 | 4 | 6 |
| TOTAL | 98 | 214 | 91 | 40 | 443 | - |

number of exotic species, many of which have become feral pests, continues to be a major factor causing extinction of New Zealand's wildlife today.

The Polynesians brought with them dogs, kiore (the Polynesian rat) and the weka (a flightless rail). Early accounts of the arrival of Captain Cook in 1773 mentioned cats and rats going ashore from ship's gangways. From 1879 onward, Europeans either accidentally or deliberately introduced a huge array of northern hemisphere species. Acclimatisation societies were responsible for introducing a total of 65 species of land-breeding mammal including such oddities as the zebra, moose and gnu (King 1990). Today the European rabbit, brown hare, eight species of deer, goat, tahr and chamois are locally abundant and cause intense browsing damage. Predatory species like the feral cat, three species of Mustelids, hedgehog, brushtail possum and four species of rat continue to have a major impact on native wildlife. Fourteen species of marsupial, including the tammar, Bennett's wallaby, brushtailed rock-wallaby and parma wallaby, were introduced from Australia of which half have become locally established. By far the most devastating marsupial introduction was the brushtail possum *Trichosurus vulpecula* which is now a common and widespread species of urban and rural areas. The numbers of introduced species which have established in New Zealand are as follows : terrestrial mammals, 31; terrestrial breeding birds, 34; reptiles, 2; earthworms, 19; amphibians, 2; freshwater fish, 20; insects, ~1500; freshwater molluscs, 5; grasses, 255; flowering plants, 1587 (Department of Conservation 1994a).

**BRUSHTAIL POSSUMS**

Control of feral pests attains the highest priority in New Zealand's conservation efforts. In 1993/1994 the Department of Conservation spent $32 million on pest management and from that budget $8 million was allocated specifically for possum control (Department of Conservation 1994b). It is estimated that there are now over 70 million brushtail possums in New Zealand and that they are spread over 92% of the land area (Department of Conservation 1993). They are considered a major browsing pest and a significant predator of chicks and eggs.

A major step toward efforts to control brushtail possums took place on Kapiti Island, situated about 5 km off the west coast, north of Wellington. The island is 1967 ha in size, has steep forested hillsides and gullies, is bounded by sheer cliffs and cloaked in a variety of vegetation from grassland to broadleaf forest. In 1893 ten brushtail possums, imported from Tasmania, were released onto Kapiti to boost the fur trade. They quickly multiplied and decimated the island's vegetation. In an attempt to manage possum numbers the Department of Conservation employed commercial trappers who, between 1980 and 1983, removed 15 631 possums. As an experiment, trapping was then stopped to determine the subsequent recovery rate of the possum population. The increase in possum numbers was staggering. It took four years of intensive effort and a cost of over two million dollars to eliminate the species once the decision to eradicate (rather than control) had been made. By 1987 over 22 500 possums had been exterminated using a combination of steel jaw traps, shooting, and tracking with dogs (Sherley 1992). Over 800 km of walking track was cut across the island to enable essential access for trappers. This alone had a significant impact on vegetation.

Less than 10 years after the removal of possums, Kapiti Island bears little evidence of the massive eradication program and is now a prominent national wildlife sanctuary. Threatened species such as the takahe *Porphyrio mantelli*, saddleback *Philesturnis caranculatus*, stitchbird *Notiomystis cincta* and a significant population of little spotted kiwi *Apteryx owenii* have been liberated onto the island. Kapiti also boasts a variety of rare species such as kaka *Nestor meridionalis*, North Island robin *Petroica australis longipes*, kereru *Hemiphaga novaeseelandiae*, weka *Gallirallus australis* and several rare plants. Kapiti Island is one of the few places where the people of New Zealand can visit (under restricted permit) and actually have contact with native species in relatively undisturbed surroundings.

Possum eradication on this scale was a milestone for the Department of Conservation and its success set the standard and direction of subsequent pest eradication programs throughout the world. By 1990 a total of 13 species had been intentionally eradicated from 60 islands in 85 distinct operations in New Zealand (Towns *et al.* 1990). More recently rats have been eradicated from the rugged and densely vegetated Breaksea Island, proving that some tasks previously thought impossible can now be tackled with confidence (Taylor and Thomas 1993). The restoration of species and habitats as a result of pest removal is considered well worth the conservation and financial effort.

## LESSONS FOR TASMANIA

Public access to native wildlife in New Zealand is becoming increasingly difficult. Although approximately one third of the country (the same proportion as in Tasmania) is reserved in national parks, forest and maritime parks, these reserves predominantly offer scenic and recreational attractions rather than a wildlife experience. Even the countries national emblem, the kiwi, is virtually impossible to see in the wild and the public and tourists are limited to viewing this species in wildlife parks. With over 60% of the nation's native birds on the threatened species list, many having little chance of ever being released back into their natural habitat, New Zealand's wildlife crisis is a heartbreaking realisation and dilemma for conservationists.

The general perception of many people in both New Zealand and Tasmania is that the future of their wildlife is secure because of the large percentage of land protected in various reserves. Unfortunately feral pests do not discriminate between reserved and unreserved land and our relative inability to eradicate or effectively control many of these pests means their impact continues unabated. Following in New Zealand's footsteps of pest invasion, Tasmanian ecosystems have to contend with the introduction of European carp and trout to its waterways, feral pigs on the Bass Strait islands, feral cats and goats, deer, mice and rats, starlings, rabbits and hares, tortoises released in creeks, to name but a few. As a state we live in constant fear of the introduction of the fox, one species which could potentially cause massive decline of all our small mammals and ground dwelling birds. Other disasters such as the escape of ferrets kept as pets could well be avoided by totally prohibiting the entry of this species. The new high altitude *Phythopthora* species located at Pine Lake, the spread of gorse, ragwort, *Spartina*, blackberry, Himalayan honeysuckle, pampas grass, foxgloves and so on, are an array of weeds and diseases that further impact on our native wildlife. Without stronger management actions and tighter legislative controls in place it is likely that Tasmania's biodiversity will suffer dramatic change over the next decade.

As an island Tasmania has the advantage of being able to place workable controls on introductions. New Zealand's experience must serve as a constant reminder of the consequences of not taking action sooner rather than later. Ultimately the lack of prevention will result in massive remedial costs, as evidenced recently by the proposed eradication of European carp. Compared to New Zealand, Tasmania is in the enviable position of being able to offer a diverse and spectacular array of wildlife accessible in their native habitat to tourists and Tasmanians alike. To protect this asset exotic species must be strictly prohibited or eradicated from all native environments and Tasmania's goal to do so should be actively encouraged and promoted as an economic benefit. Interestingly tourism is the third largest contributer to the New Zealand economy. Despite their wildlife being decimated they have developed innovative ways of advertising, promoting and protecting natural attractions of more common mega-species such as penguins, whales and seals. If promoted in a sensitive and intelligent manner there is no reason why Tasmania's scenic splendour coupled with its unique wildlife cannot increase as a major drawcard to rival that of New Zealand and infact many other parts of the world.

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# IDENTIFICATION AND NATURAL HISTORY OF *DISCOCHAROPA MIMOSA*, A TASMANIAN ARBOREAL CHAROPID SNAIL

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*Abstract.* The history of knowledge of the Tasmanian charopid snail *Discocharopa mimosa* (Petterd 1879) is discussed. Shell features are quantified and the species' unique colour pattern is illustrated for the first time. As *mimosa* is known not to belong in the genus *Discocharopa*, comparisons with other south-eastern Australian charopids are made, although generic reallocation is not attempted. The species is widely distributed, but there are only thirteen known records. *D. mimosa* is arboreal in habit, being found mainly on tree branches in wet forest.

## INTRODUCTION

*Discocharopa mimosa* (Petterd 1879) has rarely been collected, until recently being thought to be extinct. In this paper I discuss the history of the species, outline what is known of its taxonomic status and collate information on distribution and habitat.

## TAXONOMIC HISTORY

Published descriptions and taxonomic reallocations of *D. mimosa* are as follows:

*Helix mimosa* Petterd 1879
*Endodonta mimosa* Petterd and Hedley 1909
*Discocharopa mimosa* Iredale 1937

Petterd (1879) described *mimosa* (as *Helix mimosa* ), and gave the type locality as "First Basin near Launceston, among mosses on the branches and trunks of trees". One syntype still exists, in the collection of the Australian Museum (AM C23041) (Smith 1992). The number of specimens found by Petterd is unknown but was probably around ten, as he remarks both on the species' scarcity and its constant character. Petterd gave two other localities, Gad's Hill and Chudleigh, with no further comments.

Petterd and Hedley (1909) gave only Launceston as a locality for the then *Endodonta mimosa* . They also figured a shell from the collection of the Tasmanian

Museum ("one of the type series") but didn't include any colour pattern. May (1923) also figured a white specimen, possibly the same shell, and gave the colour pattern as "banded". It is unlikely that both figures would have omitted a pattern that was present on the shell. Whether such a white specimen would be natural or have resulted from fading before or after collection is unknown.

*Discocharopa* initially included the Kermadec Islands "species" *D. exquisita* (Iredale 1913) and the Tasmanian species *bassi* (Legrand 1871). Later several other forms, superficially similar, were added (Solem 1983). Among these were *mimosa* and two other Tasmanian names *vigens* (Legrand 1871) and *lottah* (Petterd 1879), now usually treated as *bassi* synonyms.

Lack of further records and shortage of museum specimens caused *mimosa* to become increasingly obscure. Of the pre-1980 specimens in Tasmanian collections under the name *mimosa*, all those in the Queen Victoria Museum are *lottah*, and of those in the Tasmanian Museum collection the Flinders Island specimen (TM E 1012) is most probably a *Pernagera* or *Allocharopa*, and the Cataract Gorge specimen (TM E 1011) is unusable due to loss of the spire, a common fate of Petterd Collection specimens which were stuck on pieces of card. This situation contributed to errors in Smith and Kershaw (1979), in which *D. mimosa* was included with a description derived from Petterd (1879). However, the protoconch was said to be "of radial riblets to smooth", and the illustration showed a predominantly white shell with clearly defined regular rays. Flinders Island was included as a locality, and *lottah* as a synonym.

Solem (1983) stated that all Tasmanian "*Discocharopa*" seemed incorrectly placed, as *D. aperta* (Mollendorff 1888), of which *D. exquisita* is a synonym, has a distinctive sculpture with no spiral adult sculpture. Stanisic (1990) has a good SEM photograph of this feature.

Despite extensive searches by both Ron Kershaw and myself, *D. mimosa* has not been relocated in Cataract Gorge, and other localities given in Petterd (1879) were somewhat vague. Kershaw (1988) said of *mimosa*: "I do not know if this is extinct but the possibility must be present". In fact *mimosa* had been rediscovered by Vince Kessner in 1982, but the specimens remained unidentified in the Queen Victoria Museum until 1994. As early as 1990 I suspected that available *mimosa* specimens belonged to a new species as they appeared not to match Petterd's (1879) original description. However, in 1993 I realised that perceived differences between *mimosa* and these specimens were illusions due to archaic language in Petterd's descriptions, in particular the use of the term "striae" (now used for very fine sculpture) to denote the actually quite bold primary ribbing. Statistical comparisons between Petterd and Hedley's illustration and modern specimens confirmed that *mimosa* still existed.

## IDENTIFICATION

As Petterd (1879) is fairly readily available in Tasmanian libraries, the full original description is not given here. Petterd's description contains extensive discussion of fine points of shell shape but suffers in its lack of quantification. The following description, based on study of all known specimens currently in Tasmania, is aimed at filling gaps in Petterd's description.

Adult and near-adult shells of 3.6 to 4.2 (Petterd claims 4.5) whorls are 1.6 to 2.0 mm wide, and have a width/(whorls)$^2$ ratio of 0.105 to 0.135. The protoconch of 1.6 to 1.9 whorls is very shiny and usually appears smooth at X50 magnification, but often has about eight very barely visible, slightly wavy spiral grooves. On some specimens these are clearly visible. The first adult whorl has 45-75 ribs and spatial rib density is quite constant on later whorls. The umbilicus is 0.60-0.75 mm wide, a very consistent 34-40% of shell width. Ribs are slightly and smoothly angled towards the aperture. There are about 5-6 low radial lines between adjacent body whorl ribs and some spiral elements mainly near the sutures. The colour pattern was described by Petterd as "reddish brown, irregularly rayed and blotched with pure white", and it is hard to improve on this without going into great detail (Fig. 1). There is substantial variation between specimens, but

**Fig. 1.** *Discocharopa mimosa* showing the typical colour pattern and primary sculpture. Scale bar represents one mm. Specimen is from Montos Creek.

the dominance of dark reddish brown (pale orange red in dead shells) over white is constant. The white blotches are always more ray-like on the early whorls but on the body whorl they seldom maintain a straight form for more than 0.25 mm. On the underside white blotches are very visible around the perimeter but difficult to make out near the umbilicus. There are from 9-12 predominantly white areas ("pseudo-rays") on the last whorl above and a similar number of perimeter blotches below.

## COMPARISON WITH OTHER SPECIES

The adult sculpture is quite similar to *Pernagera*, in which the domination of radial interstical sculpture occurs variably in all Tasmanian species (least in *P. kingstonensis* (Cox 1868)). However, *P. tasmaniae* (Cox 1868) has as many as 15 interstical radials between adjacent ribs. Radial domination also occurs in *Dentherona*, but interstical sculpture there is bold, rough and of inconsistent height. The other so-called *Discocharopa* forms (*vigens / bassi / lottah*, probably all one species) are little studied but some specimens have fully reticulate secondary sculpture as in *Allocharopa* and *Stenacapha*.

The gross shell form features of size, shape and number of whorls are incompatible with *Pernagera*. *Allocharopa* is more similar here, as is *Roblinella gadensis* (Petterd 1879). The Victorian *Discocharopa inexpecta* (Gabriel 1947) is superficially very similar but has fully reticulate interstices, and connections with *Geminoropa* are likewise unlikely. The mainland genus *Rhophodon* is more promising if the interstical sculpture is correctly described in Smith and Kershaw (1979). There is no appropriate Tasmanian genus for *mimosa* but more work will be required to determine whether any mainland genus is suitable. Furthermore, no anatomical study of *mimosa* has been undertaken at this stage.

The colour pattern of *mimosa* is unique in Tasmania and I am not aware of any such pattern on snails from mainland Australia. Of Tasmania's estimated 59 native snails, 31 reliably have essentially single-coloured shells. A further five are usually single-coloured but occasionally have weak regular radial rays, while another 17 often or usually have strong radial colour rays. Two are slugs, two have spiral lines only, leaving only *Tasmaphena sinclairi* (Pfeiffer 1846) and *mimosa* as more complex forms. The adult colour of *T. sinclairi* is usually spiral anyway, and the mottled pattern present mainly on juvenile stages is quite regular. Why does *mimosa* have such a complex pattern in a fauna dominated by extreme simplicity? Certainly *mimosa* is brilliantly camouflaged when alive; at Montos Creek it was so hard to see that I collected three by accidentally brushing them onto my hands without seeing them. This collection method is not at all common. However, camouflage cannot be much of an asset for a snail two mm wide and preyed on chiefly by invertebrates with rather limited eyesight. Many snails with dark colour rays on a light background have occasional ray-less forms. No such form of *mimosa* has yet been adequately confirmed, but such a form would, if light, suggest that the *mimosa* pattern is a complex development of the normal charopid ray pattern. If such a form were dark-coloured, it would suggest the *mimosa* colour patterning is an independent development.

## DISTRIBUTION, HABITAT AND MICROHABITAT

Details of the thirteen known locality records of *mimosa* are as follows:

1. Cataract Gorge (Grid Reference 5097 4118) W.F. Petterd (1879), type location. Found "among mosses on the branches and trunks of trees" (presumably *Pomaderris, Olearia* and/or *Acacia*). Number not known, estimated at around ten. No known collection this century, despite deliberate searches by Ron Kershaw and myself. Most of the wettest habitat at this site is now too degraded and the population is probably extinct.
2. Chudleigh (G.R. 4570 3990) Petterd (1879). Exact locality unknown, possibly nearby Alum Cliffs area. No further information.
3. Gad's Hill (G.R. 4300 3974) Petterd (1879). No further information.
4. Mt. Arthur near Lilydale (G.R. 5230 4310). V. Kessner, November 1982. Found "on tree trunks under moss in rainforest". Four specimens (dry but perhaps live collected).
5. Adamson's Falls Track (G.R. 4874 1978) K. Bonham, April 1988. One dead in leaves in wide low fork of regrowing myrtle tree, mixed forest.
6. Big Sassy Creek (G.R. 5749 3332) P. Greenslade (National Rainforest Conservation Project), May 1989. One collected live by pyrethrum knock-down from sassafras tree in remnant rainforest.
7. St. Patricks Head (G.R. 6035 3966) K. Bonham, October 1990. One dead in litter in low *Olearia* fork in wet sclerophyll forest.
8. Oakleigh Creek (G.R. 4185 3733) K. Bonham, January 1991. One crumpled dead specimen on top of rock under *Pomaderris* tree in rainforest.
9. Riseborough Road, Togari Block (G.R. 3274 4708) K. Bonham/M. Mahoney, September 1992. One live crawling on ground in 60 year old wet sclerophyll regrowth with an understorey of *Pomaderris/Olearia*.
10. Marriotts Falls (G.R. 4725 2704) K. Bonham/B. Smith/H. Malcolm December 1992. One damaged dead specimen in *Olearia* fork in wet sclerophyll forest with rainforest elements.
11. Montos Creek near Ellendale (G.R. 4732 2814) S. Hanley/K. Bonham, February 1995. Fifteen live and nine dead on one thin section of *Olearia* branch, three live on thick base of another *Olearia*. All under mossy bark, wet sclerophyll forest with rainforest elements.
12. Cooks Creek near Picton River (G.R. 4725 2176) K. Bonham/R. Crookshanks/

L. Free February 1995. One dead on top of mossy log, scrubby rainforest with some emergent eucalypts.

13. Bermuda Hill (G.R. 4916 2321) K. Bonham/Tasmanian Field Naturalists Club, July 1995. Two dead on mossy *Olearia* trunk in mixed forest.

The distribution of the species is quite wide and may be close to statewide in suitable habitat (Fig. 2). For a species with so few records, *mimosa* already occurs in some of the most distant points of the state. It clearly has the lowest ratio of number of records to size of range of any known Tasmanian snail. The arboreal microhabitat is a likely factor in this. Until recently this microhabitat has received very little attention, even though 16 Tasmanian snail species are known

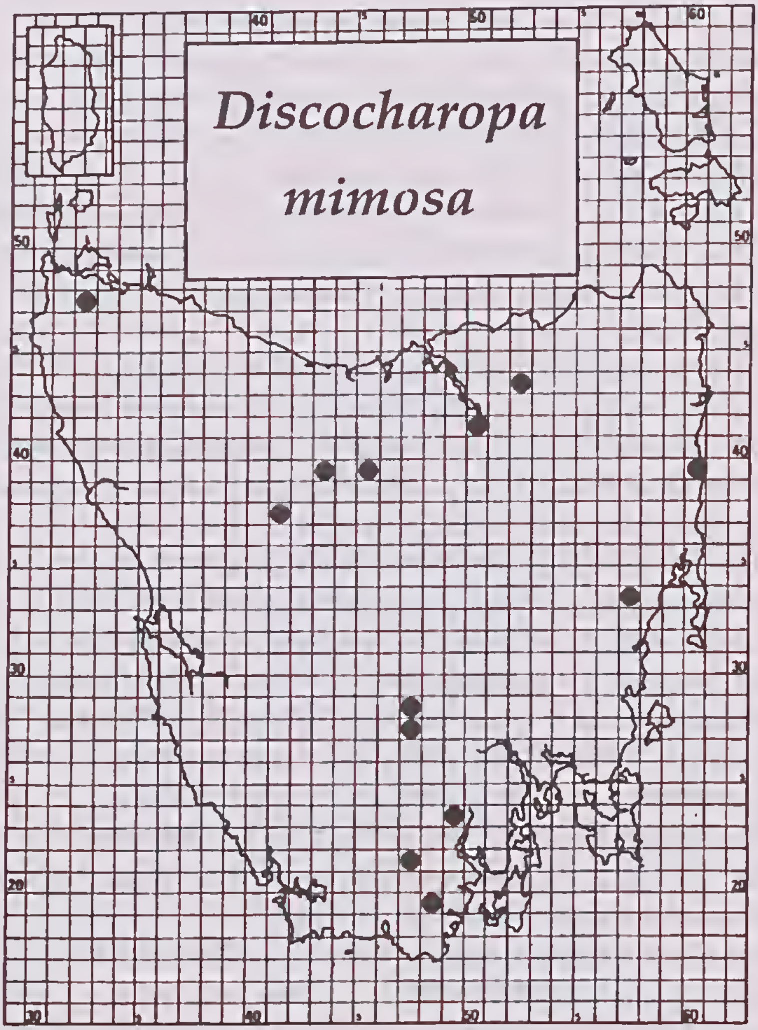


Fig. 2. Distribution records for *Discocharopa mimosa* within 10 x 10 km grid squares.

to occasionally climb trees. No species is as frequently arboreal as *mimosa*, of which there is only one unquestionably terrestrial record. The other two ground records, dead shells on top of rocks or logs, suggest that the specimens fell from trees. Even the colloquial "tree snail" *Bothriembryon tasmanicus* (Pfieffer 1853) is probably more terrestrial than arboreal, especially in coastal situations where no trees exist! The collections obtained by sampling of tree canopies using the pyrethrum knock-down technique during the National Rainforest Conservation Project (Coy, Greenslade and Rounsevell 1993) dispelled the "hardly any snails climb trees" myth. Increased searching of trees would probably reveal many more records for *mimosa*.

However, it is unlikely that the arboreal tendency of *mimosa* is the only explanation for the scarcity of the species. A snail capable of living in a wide range of wet forests (Cataract Gorge and St Patricks Head are not especially wet localities), and suspected of occurring on at least five different tree species, has every reason to be a highly successful species. Yet it is not. Several records are of single specimens only, found as a result of very serious collecting efforts, and several deliberate efforts to find the species in apparently suitable arboreal habitat have failed. The only success of any note, at Montos Creek, occurred in a habitat which did not seem very different from several other habitats where searches had failed. Although current understanding of this strange snail is an advance on its previous "presumed extinct" status, there is clearly still much to be learned.

## ACKNOWLEDGEMENTS

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# A REVIEW OF THE CONSERVATION STATUS OF THE ORCHID *PRASOPHYLLUM CONCINNUM*

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*Abstract.* The Tasmanian endemic orchid species *Prasophyllum concinnum* was previously known only from one locality and was considered endangered. This paper reports the results of recent surveys which show that the species is much more widespread than previously thought and is well reserved. It can no longer be considered as endangered but its secure status is dependent on the implementation of appropriate conservation measures.

## INTRODUCTION

The Trim Leek-orchid *Prasophyllum concinnum* Nicholls (Orchidaceae) is a Tasmanian endemic described from type specimens collected at Blackmans Bay by Dr. W. Curtis in November 1947. The types were sent to Victoria for identification (W. H. Nicholls 1948) and lodged at the National Herbarium in Melbourne. No information on its local distribution and abundance was published, apart from its occurrence in sandy heathland. The description and subsequent references to this species in the literature have been scanty and confusing. It has been mentioned as occuring at Blackmans Bay, Bridport and Pine Lake (Firth 1965), in sandy heathlands to subalpine areas (Nicholls 1969) and was described as perhaps extinct due to its habitat destruction at Blackmans Bay (Curtis 1979). Curtis (1979) listed the type locality as its distribution and recent assessments of its conservation status appear to be based on this reference.

In the spring of 1988, H. and A. Wapstra discovered numerous *Prasophyllum* plants growing in heathland of the Coffee Creek catchment above Howden on the western side of the divide between Northwest Bay and Blackmans Bay. The abundant flowering of these plants was stimulated by a hot bushfire in January 1988, but has been diminishing in subsequent years. The Wapstras were uncertain as to the identity of these plants and finally in 1992 had their identification confirmed as *P. concinnum* by orchid taxonomist David Jones of the Australian National Botanic Gardens in Canberra. This was the first known confirmation of the species from the area for possibly 45 years.

In 1991, whilst researching records for an atlas of Tasmanian native orchids, I came across a specimen lodged with the National Herbarium in Melbourne that had recently been identified by Bob Bates as *P. concinnum* . This plant had been collected by the Rev. Bufton from Bathurst Harbour in Tasmania's south west in the 1890s. Further to this, a collection of *Prasophyllum* in the Tasmanian Herbarium collected in 1984 by A. Buchanan from Labillardiere State Reserve on Bruny Island, was redetermined by David Jones as *P. concinnum*.

## FORMER CONSERVATION STATUS

The dearth of records for *P. concinnum* has resulted in the species recently being placed in two official lists dealing with the status of rare vascular plants. The first list, prepared by the ANZECC Endangered Flora Network, classified the species as endangered on a national level (ANZECC 1993). The Tasmanian Flora Advisory Committee also listed the species but rated it as rare category r1 (i.e. having a distribution that does not exceed the range of 100km x 100km)(Flora Advisory Committee 1994).

## RECENT SURVEYS AND TAXONOMIC CLARIFICATION

Due to its national threatened status the species became the subject of a flora recovery plan implemented by the Parks and Wildlife Service, Tasmania and funded by the Australian Nature Conservation Agency under the Endangered Species Programme (Ziegeler 1994). The recovery plan set out actions to conserve the species including field surveys and taxonomic research.

In November 1994 searches were conducted by the author in the localities where the species was previously known to exist i.e. Blackmans Bay, Labillardiere Peninsula and Bathurst Harbour. Other areas with similar habitat were also searched, these being coastal sites in southern Tasmania supporting wet or dry heathland. The results were as follows:

*Blackmans Bay* - In addition to the known sites two other sites were located within the Coffee Creek catchment on Huntingfield Estate. All of the sites supported small, thinly dispersed populations each of no more than about ten plants. The plants tended to occur in moderately drained open heathland on the margins of denser poorly drained sedgey-heathland. In two sites plants were found in recently-mown heathland.

*Surges Bay* - A population of six plants was found growing on the margins of wet scrub on the western side of the football oval.

*Labillardiere State Reserve* - Three populations with varying numbers of plants were found in the Lighthouse Road and Jetty Beach areas in heathland and heathy open forest.

*Mount Brown State Reserve* - Two plants were found near Maingon Blowhole. Additional plants were in heathland on private land up to 500 m to the north.

*South Port Lagoon Wildlife Sanctuary* - Small populations were located up to one km north west of Southport Bluff in moderately drained sites in wet heathland. The species was not found within Southport Bluff Historic Site.

**Table 1. Conservation status of known populations of the orchid *Prasophyllum concinnum*.**

| Location | Land tenure | Approx. no. of plants | Threats |
|---|---|---|---|
| Blackmans Bay | Crown land | 50 | Urban development |
| Labillardiere Peninsula | State Reserve | 14 | |
| Surges Bay | Recreation Reserve | 6 | |
| Mount Brown | State Reserve | 2 | |
| | Freehold | 8 | |
| Southport Lagoon | State Forest and Wildlife Sanctuary | 14 | |
| Melaleuca | South West Conservation Area | 8 | Mining |
| Mount Beattie | Southwest National Park | 5 | |

*Bathurst Harbour* - Widely dispersed populations were located in the region of Melaleuca and within the Southwest National Park on the western slopes of Mount Beattie. These were sited in areas of slightly improved drainage within *Gymnoschoenus* sedgeland /heathland.

Some other localities with likely habitat were also searched but without success. Specimens from all localites were sent to David Jones in Canberra for taxonomic confirmation. David Jones also visited the Labillardiere State Reserve sites and confirmed previously known *Prasophyllum* plants from this locality as being *P. concinnum.*

## CONCLUSION

As a result of the 1994 field surveys, *P. concinnum* is now known to be widely dispersed in southern Tasmania. Incorrect identification may account for past references to its occurrence in other parts of Tasmania. The genus *Prasophyllum* in Tasmania has suffered from a great deal of past taxonomic misconception. Collections lodged under the names of *P. gracile* and *P. fuscum*, both of which are now known not to occur in the state, need re-examination.

*Prasophyllum concinnum* is now known to have a distribution range of greater than 100 X 100 km and to occur within seven 10 x 10 km Australian Map Grid Squares (Fig 1.). The species is reserved in Labillardiere State Reserve, Mount Brown State Reserve and South West National Park (Table 1). Despite the extension of its distribution and its adequate reservation status, the species' long term survival depends on suitable conservation management procedures, such as appropriate fire management practices, being implemented.

Based on the data now available the species no longer fits the definition of endangered but does fall into the category of lower risk (conservation dependent) according to the latest IUCN threatened species criteria (IUCN Species Survival Commission 1994). This listing means that the species is the focus of conservation measures, the cessation of which would result in the taxon qualifying for a higher risk category within five years. The ANZECC listing was based upon the species' rarity as assessed by Briggs and Leigh (1988). Based on its extended geographical distribution, the Tasmanian Flora Advisory Committee listing should be changed from rarity status r1 to r2 (Taxa which occur in 20 or less 10 X 10 Australian Map Grid Squares in Tasmania ).

The change in the perception of its conservation status was made possible by application of conservation research, and is an example of the value of such research on Australia's endangered flora species.

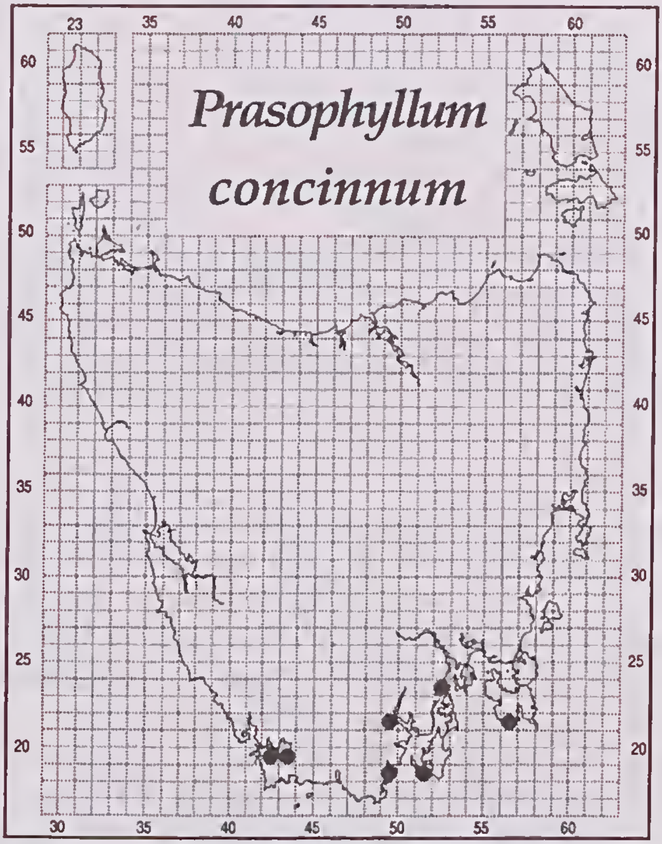


**Fig.1** Distribution records for *Prasophyllum concinnum* plotted within 10 x 10 km grid squares.

## ACKNOWLEDGEMENTS

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# A SURVEY OF HOODED PLOVERS *THINORNIS RUBRICOLLIS* ON CAPE BARREN ISLAND

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## INTRODUCTION

The hooded plover *Thinornis rubricollis* is a medium-sized stocky plover with a black hood, red bill tipped black and short orange legs. Hooded plovers inhabit ocean beaches and adjacent sand dune areas, bays, rock-shelves and reefs. They prefer sandy beaches, especially those which are broad and flat, with a wide wave-wash zone for feeding. They forage especially in wave-wash areas, lagoon edges and saltpans. (Marchant and Higgins 1993).

Hooded plovers occur on the coast of the south and south-east Australia and in south-west Western Australia. (Marchant and Higgins 1993). The total population in Tasmania was estimated at 1730 in 1984 (Newman and Patterson 1984).

An extensive survey of hooded plovers was carried out in October 1992 by staff from the Department of Parks and Wildlife and members of the Bird Observers Association of Tasmania. They were assisted by other interested enthusiasts. Observers visited many sandy beaches throughout the State. The survey included King, Swan and Flinders islands but not Cape Barren Island or the other smaller Bass Strait Islands. This count recorded 865 birds on 500 km of beach at an average of 1.73 birds per km (Holdsworth and Park 1993).

Moore (1994) carried out a survey of hooded plovers on Cape Barren Island between 27 December 1993 and 2 January 1994. His visit was characterised by strong winds from the south-east and west, with periodic rain squalls. Although not stated in Moore (1994), the 1993/4 average density of hooded plovers can be calculated from figures in the paper as 0.40 per km of beach walked. He observed that the density of hooded plovers was less than half of the average density of Tasmania as reported by Holdsworth and Park (1993) and commented that better weather conditions may have increased the count.

This paper reports on a recent survey of hooded plovers on Cape Barren Island undertaken by the authors.

## METHODS

We visited Cape Barren Island during the period 23 December 1994 to 2 January 1995. During this time we walked around most of the island in a clockwise direction, from Puncheon Point in the far north-east to Cape Barren settlement. We covered almost all the sandy beaches on the east, south and part of the west coasts. We did not visit the north coast. Weather conditions were fine and mostly sunny with winds from the west or north-west. As with Moore's (1994) visit the winds were strong to gale force at times with little calm weather. In common with Moore (1994), we counted birds while walking along the beaches and did not make special detours for bird observations.

## RESULTS

We saw a total of 46 hooded plovers on 49.5 km of beach during our observations compared with Moore's (1994) 1993/1994 count of 24 birds. The largest number of birds we saw in any one group was five with no juvenile birds seen. A full list of our observations is given in Table 1.

**Table 1. Comparison of the numbers of hooded plovers recorded in locations around Cape Barren Island during two surveys, by Moore in 1994/95 and during this study in 1994/95.**

| | Length of beach (km) | No of Birds Recorded 1993/94 (Moore 1994) | 1994/95 (this study) |
|---|---|---|---|
| Puncheon Point – Little Creek | 5 | 4 | 7 |
| South from Little Creek[1] | 6.5 | 8 | 13 |
| Inland lagoon east of Hogans Hill | 2.5 | 0 | 3 |
| Thirsty Point[1] | 1 | 3 | 0 |
| Jamiesons Bay | 3 | 0 | 2 |
| Burgess Bay | 2.5 | 0 | 0 |
| Christmas Beach | 3 | 2 | 0 |
| Crows Beach | 1 | 0 | 0 |
| Crystal Lagoon | 3 | 5 | 3 |
| Kent Bay | 8 | 2 | 6 |
| Nautilus Cove | 2 | 0 | 0 |
| Battery Bay | 2 | 0 | 0 |
| Dyas Bay | 3 | 0 | 1 |
| Brearleys Beach | 2 | 0 | 2 |
| Key Island Bay | 2 | 0 | 2 |
| Modder River entrance | 1 | 0 | 3 |
| Thunder & Lightning Bay | 1 | 0 | 2 |
| Freds Beach | 1 | not visited | 2 |
| **TOTAL** | **49.5** | **24** | **46** |

[1] We walked about 7 km less beach in these two sections than walked by Moore (1994).

discussion

The density of birds we recorded on Cape Barren Island in 1994/5 averaged 0.93 per km of beach walked. This is well above the average of 0.40 birds per km of beach noted by Moore (1994), and may be explained in part by the poor weather during Moore's visit. The 1994/5 average density is still well below the average of 1.73 per km found for other areas in Tasmania and islands in the Bass Strait (Holdsworth and Park 1993). Superficially this is difficult to explain, as most of the south east of Cape Barren Island is uninhabited. The only obvious human interference is that wildfires appear to have been very common with some areas of heathland severely degraded, but this would appear to have little impact on the beach. We attempt a more detailed analysis of the overall result below.

The north-east coast of Cape Barren Island shows up a healthy population of birds in both surveys (average density of 1.74 birds per km in 1994/5). This is a typical ocean sandy beach, with low dunes behind vegetated in parts by grasses and shrubs. Of the other ocean beaches facing south-east, Jamesons Bay is a typical ocean beach, Christmas Beach was several hundred metres wide at low tide during our visit and Crows Beach is formed of very large sand particles with an extremely steep ocean wash. These last two beaches make observations difficult and may be unsuitable for hooded plovers.

From Kent Bay to Brearleys Beach there is exposure only to limited wind waves, as Clarke Island is only a few kilometres offshore. At the heads of each bay are sandy beaches that are gently shelving, often with extensive sea grass flats exposed at low tide. Such habitats seem to be infrequently used by hooded plovers (average density of 0.53 birds per km in 1994/5, and this is mainly due to 0.75 birds per km on the west facing beach in Kent Bay–the most exposed beach in this section).

The relatively small beaches on the western end of Cape Barren Island, exposed to the swells in Bass Strait are occupied by hooded plovers in reasonable numbers again (average density of 1.75 birds per km in 1994/5).

Hooded plovers were also present at the inland lagoon east of Hogans Hill and at Crystal Lagoon (average density of 1.09 birds per km in 1994/5). Both these lagoons are very scenic with wide, shelving sandy beaches. We walked around both these lagoons during our visit. Crystal Lagoon was slightly salty but the lagoon east of Hogans Hill had a much higher saline level. The dry conditions in the preceding months may have caused these lakes to be more salty than usual. Such observations from inland lagoons are occasionally reported from Tasmania, both on the east coast, perhaps as lagoons dry out (Newman and Patterson 1984), and in the far north-east (Cooper 1993). In Western Australia hooded plovers are often found around margins and shallows of near-coastal or inland open saltlakes and less often on coastal beaches (Marchant and Higgins 1993).

## CONCLUSION

Analysis of the distribution of hooded plovers observed in our 1994/5 visit highlights their preference for beaches with steady consistent ocean wash. On many ocean beaches the density of birds observed was consistent with the 1992 survey of Tasmania. In contrast, beaches sheltered by Clarke Island support a much reduced density of birds. The two inland lagoons which have no ocean wash, but a consistent tideless shoreline, support an intermediate density of birds.

## ACKNOWLEDGMENTS

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# MAMMALS OF GUMTOP SPUR IN THE NORTHWEST OF WELLINGTON PARK WITH COMMENTS ON A NEW HABITAT TYPE FOR THE BARRED BANDICOOT

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## INTRODUCTION

Mt Wellington is a cultural icon for Hobart. While the fauna of the eastern slopes above the city in Mountain Park has been extensively studied (summarised by Taylor and McQuillan 1994), and vegetation zonation described (Ratkowsky and Ratkowsky 1977), biological and conservation values of the greater Wellington Range are relatively poorly known.

The western end of Wellington Park appears to be less impacted by visitation than Mountain Park, both currently and historically. Mammals of conservation significance (e.g. barred bandicoot and bettong) have been regularly observed killed on Boyer Road (D.G. Hird pers. obs.) which passes through fringing foothills, including Gumtop Spur, near the north western end of the Wellington Range. Bushwalking in the area had also indicated extensive signs of mammal usage. A survey of the mammals of Gumtop Spur was undertaken in habitats comparable to that in Mountain Park in order to investigate the possible effects of the high usage of the latter area on the mammals and to assess the conservation significance of the area.

## STUDY AREA

Gumtop designates a spur which originates near the confluence of the Lachlan and Derwent Rivers and extends south easterly towards Mt Marian, some 12km west of Mt. Wellington. It divides the watersheds of Illa Brook to the west and the Glen Dhu Rivulet to the east. A firetrail, Ringwood Track, traverses the spur but is infrequently used and gated at the western boundary of the public land boundary. Lower western and northern slopes have been subject to extensive land clearance while forestry dating from the early 1900's is evident on the ridge proper. Management of the Wellington Range has a patchy history and is currently under review by the Wellington Park Management Trust under the authority of the Wellington Park Act, 1990. Prior to vesting of the area under the Wellington Park Trust the area was part of the Wellington Range Protected Area, including part of the Lachlan Water Catchment.

Triassic sandstone substrates on the Gumtop spur which were traversed by the Ringwood Track were selected for survey. Similar, although less extensive, substrate occurs at similar altitudes within Mountain Park in the vicinity of The Springs. Jurassic dolerite substrates are present to the west and south of Gumtop at lower altitudes, below 500m (Leaman, 1972 and D. Hird pers. obs.).

Two topographic features were evident along the track. Travelling south east from the Wellington Park boundary along Ringwood Track, steep slopes with prominent outcropping sandstone and surface rock are present (Grid Reference 5061 2568). After one kilometre and an increase in altitude from around 500 to 650m, the slopes ease as a plateau of around 2.5 $km^2$ is reached and less exposed sandstone is evident. Geologically these areas are predominantly medium-coarse quartz sandstone on the slopes with predominantly massive quartz mudstone on the plateau (Leaman 1972).

## METHODS

Trapping was carried out using wire cage treadle traps (0.55 x 0.2 x 0.2m) and Elliott small-mammal traps (0.35 x 0.1 x 0.09m). Cages were baited with either peanut butter spread on potato or beef offcuts in a ratio of 2:1 and small mammal traps with an mixture of peanut butter and rolled oats. Four transects, each of around 150m, were located by systematic sampling (Taylor and Friend 1983) with two replicates, separated by 200m, in the slopes and two on the plateau. A description of the vegetation of each of the transects is given in Table 1. The altitude of transects varied between 550 and 650 m. On each transect 10 cages were deployed about 15 metres apart, with two or more Elliott traps within 3 metres of each cage. The transects (number 4, 2, 3 and 1 respectively) were located 0.6, .0.8, 1.4 and 1.6 km southeast of the Ringwood Track boundary gate (grid reference above). Access was constrained by the need to walk into the area daily to check the traps after their initial deployment.

Plant community data were collected by sampling all plant species within 15 metres of each transect. Plants were identified with the assistance of the Tasmanian Herbarium. Each transect was trapped for three sequential nights during April 1995. Casual sightings and definitive tracks and signs of fauna were noted, and 1.5 hours spotlighting was undertaken. The Parks and Wildlife Service's TasPaws database was searched for vertebrate records from the area.

## RESULTS

The majority of captures were of eastern quolls *Dasyurus viverinus* (four, seven, five and four on transects one to four respectively) with one potoroo and one barred bandicoot on transect one. No mammals were captured in Elliott

**Table 1. Details of the habitat present on four transects where mammal trapping was undertaken on Gumtop in the northwest of Wellington Park.**

| | TRANSECT 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Aspect | flat | westerly | flat | westerly |
| Slope | zero | $30^0$ | zero | $40^0$ |
| Logging history | selective (late 19th Century) | unlogged | selective (late 19th Century) | unlogged |
| Vegetation community* | DEL 0111 | DEL 0111/DEL 0010 | DEL 0010 | DEL 0000 |
| Trees | *E. delegatensis*<br>*E. johnstonii*<br>*Acacia dealbata*<br>*A. melanoxylon* | *E. delegatensis*<br>*E. coccifera*<br>*Acacia dealbata* | *E. coccifera*<br>*E. delegatensis* | *E. dalrympliana*<br>*E. delegatensis*<br>*Acacia dealbata* |
| Shrubs | *Monotoca linifolia*<br>*Oxylobium ellipticum*<br>*Cyathodes glauca*<br>*Lomatia tinctoria*<br>*Leptospermum scoparium*<br>*Helichrysum dendrobeum*<br>*Phebalium squameum* | *Monotoca linifolia*<br>*Oxylobium ellipticum*<br>*Cyathodes glauca*<br>*Lomatia tinctoria*<br>*Olearia phlogopappa*<br>*Amperea xiphoclada*<br>*Davesia ulicifolia* | *Monotoca linifolia*<br>*Olearia viscosa*<br>*Cyathodes glauca*<br>*Lomatia tinctoria*<br>*Helichrysum dendrobeum* | *Leucopogon ericoides*<br>*Oxylobium ellipticum*<br>*Richea procera*<br>*Lomatia tinctoria* |
| Ground layer | *Pteridium esculentum*<br>*Dianella tasmanica*<br>*Billardiera longiflora*<br>*Blechnum nudum*<br>*Gahnia grandis* | *Pteridium esculentum*<br>*Dianella tasmanica* | *Pteridium esculentum*<br>*Dianella tasmanica* | *Pteridium esculentum*<br>*Dianella tasmanica* |

* These are the closest categories under the schema for wet sclerophyll given in Kirkpatrick *et al.* (1988)

traps on this survey. A wombat (*Vombatus ursinus*) was sighted during the day and many of their scats were observed. Scats of Tasmanian devils *Sarcophilus harrisii* and pademelons *Thylogale billardierii* were common along the Ringwood Track and those of brushtail possums *Trichosurus vulpecula* and Bennett's wallabies *Macropus rufogriseus* were occasionally observed. Three bats were seen during spotlighting.

## DISCUSSION

The primary significance of these survey results lies in the possibility of forested habitat being utilized by eastern barred bandicoot and the presence of mammal species which are absent from similar habitats in the more heavily utilized areas closer to Hobart.

The Tasmanian population of the barred bandicoot is of national significance because of its catastrophic population decline to a point of imminent extinction on mainland Australia (Lacy and Clark 1990). It remains widespread and abundant in Tasmania, although its habitat requirements are only broadly known and it is inadequately represented in reserves (Driessen and Hocking 1991). Tasmanian mammal distributions have been mapped to 10 $km^2$ grid squares (Rounsevell et al. 1990). However, the data used was mostly collected opportunistically and habitats in many areas have not been systematically surveyed.

Preferred habitat for the barred bandicoot in Tasmania is considered to be areas of grassy woodland and forest (Watts 1993), and including heathland (Green 1973). Frequent comment is also often made of the prevalence of the species in agricultural areas. Heinsohn (1966), for example, found that highest population densities occur in mosaics of scrub and pasture. Of relevance to this study is the report of the species in the Mountain Park as being associated with areas of pasture, for example at The Springs (Taylor and McQuillan 1994). It is also common on the areas of pasture and urban gardens fringing Mountain Park (Tasmanian Field Naturalists Wildlife Survey Group records).

The barred bandicoot trapped in this survey was at least 1.5km from known areas of grassy forest. The capture of one individual could possibly just be an individual dispersing through unfavourable habitat. However, two other broadly comparable sightings in forested areas within Mountain Park on Mt Wellington have recently been reported, one in *Eucalyptus obliqua* forest 200m below Shoobridge Bend (Louise Gilfedder, pers. comm.) and the other in *E. johnstonii* forest 1.8km above The Springs (Adrian Pyrke, pers. comm.).

The heavy utilisation of pasture (and a presumed non-utilisation of closed forest) by barred bandicoots led Driessen and Hocking (1991) to conclude that the species has expanded its range some 50km southward in SE Tasmania, and some 100km westward in NW Tasmania, based on an imputed absence of grassy forest. We suggest that the lack of early museum and database records cannot be considered to be reliable negative evidence of the species' use of such areas. The utilisation by barred bandicoots of heathland habitats (Green 1973), the presence of relic pockets of native grassland in NW Tasmania (Peter McQuillan pers, comm.), and the lack of timely local survey data together with substantial (ongoing) habitat alteration may have masked the presence of the species in those regions.

Barred bandicoots have a high public profile in Tasmania due to their occupation of settled areas, high levels of visible predation, especially on juveniles by domestic cats, and through roadkill mortality. This visibility may not, however, be a reliable indicator of long term conservation security. Tasmanian barrred bandicoot populations have certainly responded to the massive post-European anthropogenic habitat changes. Their abundance in disturbed areas may, with changing intensity and patterns of landuse, increase their susceptibility to population decline as evidenced on the Australian mainland. The full range of habitats utilised by the species and behavior of the species in non-grassy habitats deserves further comprehensive investigation. The fact that so little of the species' biology is recorded despite massive habitat changes in recent decades emphasises this point.

The eastern quoll is one of three "recent endemic" Tasmanian marsupials; along with the eastern bettong and red-bellied pademelon it still thrives in Tasmania despite extinction from previously much larger pre-European geographic ranges on mainland Australia. Quolls utilise a range of habitat types including wet and dry forest and woodland, and heathland (Green 1973). For Mountain Park, it was erroneously included in that fauna by Taylor and McQuillan (1994) (R. Taylor pers. comm.). Despite its reputation as a notorious raider of fowl-houses it is rarely reported to local naturalists even though poultry are often kept on urban fringes. Only one quoll was trapped at Porter Hill (6 km southeast of Hobart) in 1991 despite a trapping effort involving 4,500 trapnights using peanut butter and potato bait (D. Hird, unpublished data), and had rarely been seen by local residents decades earlier (Joan Dorney, pers. comm.). Devils are also rarely reported nor are their scats often seen in Mountain Park. This is in contrast with the situation in Gumtop Spur. It thus appears that the native carnivores may be susceptible to high usage by humans including activities such as dog exercising.

The potoroo is widespread and common in areas of forest, woodland and heath in Tasmania. It is recorded in Mountain Park around Ferntree, but not recorded at the elevation at which it was found at Gumtop. The record is nonetheless within the known range of the species in Tasmania.

The absence of mammals of less than 100g bodyweight is surprising. The velvet rat *Rattus lutreolus* occurs very widely in Tasmania, including in Mountain Park and near-urban areas such as Porter Hill and Lambert Park (Hird 1995). Other mammals in this size range such as the dusky antechinus *Antechinus swainsonii* and longtailed mouse *Pseudomys higginsii* also occur in Mountain Park at similar altitudes (Hocking 1975, Driessen 1987). No introduced rodents were encountered. This contrasts with Mountain Park where house mice occur in broadly comparable habitat at The Springs (Tasmanian Field Naturalists survey data), and elsewhere (Taylor and McQuillan 1994).

In summary, Gumtop supports several mammals rarely found in Mountain Park. The wombat, pademelon and Bennett's wallaby are clearly evident at Gumtop and more widely in that area (D. Hird, pers. obs.). Although Mountain Park is not ideal habitat for these species their apparent scarcity there, along with the absence of the native carnivores, may be due to human visitation pressure. The barred bandicoot records reported here expand the known habitats of this species and its occurrence in reserves. Further investigation of the area would be worthwhile. Extensive screefields may support long-tailed mice in the Illa Brook catchment and the lowland valley tract here is potential habitat for the bettong (although largely private land). Elevated wetlands like Midsky Swamp may corroborate the imputed Broadtooth Rat record from Mountain Park (Taylor and McQuillan 1994).

This survey illustrates both the value and need for the work of skilled naturalists who, with appropriate encouragement and assistance, can produce significant results (e.g. Hampton *et al.* 1982).

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# RESCUE AND REHABILITATION OF WILDLIFE FROM THE *IRON BARON* OIL SPILL IN NORTHERN TASMANIA

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## BACKGROUND

On the night of July 10, 1995 the *Iron Baron*, a BHP (Broken Hill Propriety Ltd.) owned and operated bulk ore carrier, ran aground on Hebe Reef at the mouth of the Tamar River. The carrier contained a cargo of 26000 tonnes of manganese ore for delivery to the Temco smelter at Bell Bay and was holding approximately 600 tonnes of bunker fuel. The fuel tanks were ruptured and oil was carried by the tides and prevailing winds into Bass Strait and the Tamar River.

In Bass Strait a major slick washed past Tenth Island, a breeding site for Australian fur seal *Arctocephalus doriferus* and then onto Ninth Island which contains significant breeding colonies of little penguin *Eudyptula minor*, common diving-petrel *Pelecanoides chathamensis*, white-faced storm petrel *Pelagodroma dulciae*, black faced shag *Leucocarbo fuscescens* and short-tailed shearwater *Puffinus tenuirostris*. In the Tamar River the oil moved easterly between Low Head and East Sandy Point and westerly between West Head, Hawley Point and Point Sorell. These areas are surrounded by cobble and boulder beaches containing breeding colonies of little penguins. Further south toward Lagoon Bay and Gibson's Beach and around Port Sorell significant wetlands, tidal mudflats and small offshore islets attract a range of migratory wading and Palaearctic birds. The more common species recorded in these regions include red-necked stint *Calidris ruficollis*, curlew sandpiper *Calidris ferruginea*, ruddy turnstone *Arenaria interpres*, eastern curlew *Numenius madagascariensis*, greenshank *Tringa nebularia*, lesser golden plover *Pluvialis dominica*, grey-tailed tattler *Tringa brevipes* and whimbrel *Numenius phaeopus* (Cooper 1975, 1976; Henderson 1979, 1981; Ashby 1991).

On the 16 July the *Iron Baron* was refloated and anchored approximately two nautical miles off Low Head. Eleven days later she was towed through Banks Strait to approximately 60 nautical miles off the northeast coast of Flinders Island where she was scuttled on the 30 July. The islands in Banks Strait such as Forsyth, Passage, Preservation, Goose, Waterhouse and Swan Island were monitored to detect the impact of the oil slick as the boat passed.

The appearance of an oil spill depends on the level of light and prevailing wind conditions under which it is observed. According to the oil spill glossary (GPO 1985) oil slick types vary from a light sheen which is a light, almost transparent layer of oil, to brown oil which is typically a 0.1 - 1.0 mm thick layer of water-in-oil emulsion, tar balls or weathered oil that has formed a pliable ball, to pancakes or discrete circular patches of oil varying from a few to hundreds of metres in diameter. The oil released from the *Iron Baron* was observed in all these forms.

## IMPACT OF OIL ON BIRDLIFE

The effect of oil on seabirds is devastating. It destroys the waterproofing of feathers which leads to hypothermia and causes clinical problems through vapour inhalation, absorption of oil through the skin and ingestion of oil by preening or food intake. The degree of oiling of wildlife observed during the *Iron Baron* oil spill ranged from lightly oiled (a small localised spot or ring on the chest) to heavily oiled (literally coated from head to foot).

## SPECIES AFFECTED

Species most vulnerable to oiling are those that spend part of their time within the surface region of the sea. Typically, diving birds such as albatross spp., diving petrels, storm petrels, giant petrels, cormorants and penguins are at greatest risk with whales, dolphins and seals also being potentially at risk.

The most obvious species affected by the *Iron Baron* spill was the little penguin *Eudyptula minor* (Table 1). Oil washed onto major runways to colonies around the coast and it was possible to capture birds in traps as they came ashore each night. A number of other species were also visibly affected by the oil but were unable to be caught for treatment. Examples are the shy albatross *Diomedea cauta*, Australian fur seal *Arctocephalus pusillus doriferus*, white-breasted sea eagle *Haliaeetus leucogaster*, pied oystercatcher *Haematopus longirostris*, hooded plover *Charadrius rubricollis* and Pacific gull *Larus pacificus*. Two Fiordland crested penguins *Eudyptes pachyrhynchus* and one northern giant petrel *Macronectes halli* were also treated during the operation but their injuries were unconnected with the oil spill.

## LOCATION AND SIZE OF LITTLE PENGUIN BREEDING COLONIES

During the rehabilitation program 2 063 little penguins were treated for oiling. Table 2 shows the estimated population size of little penguin populations at locations affected or monitored during the oil spill, where information is known.

The timing of the spill (July to August) was fortunately outside the breeding season of many bird species and also prior to the return of many seasonal migrants. Migratory waders return to the George Town area with an annual spring influx of about 400 birds around August - September but peak numbers do not occur until January to March each year (Henderson 1979, 1981). In

**Table 1. Numbers of each species treated during the *Iron Baron* oil spill and their subsequent fate.**

| Species | Rescued | Released | Died |
|---|---|---|---|
| Little penguin *Eudyptula minor* | 2 063 | 1 980 | 104 |
| Black-faced cormorants *Leucocarbo fuscescens* | 34 | 26 | 8 |
| Australian pelican *Pelecanus conspicillatus* | 6 | 6 | 0 |
| Black swan *Cygnus atratus* | 2 | 0 | 2 |
| Water rat *Hydromys chrysogaster** | 2 | - | - |
| Little pied cormorant *Phalacrocorax melanoleucos* | 1 | 0 | 1 |

*dead on arrival

**Table 2. Number of little penguins breeding in areas monitored during the *Iron Baron* oil spill.**

| Location | Size | Breeding Pairs | No. Collected |
|---|---|---|---|
| Ninth Island | 22.3 ha | 6 000 - 8 000 | 1 119 |
| Preservation Island | 182.0 ha | 250 - 300 | 1 |
| Passage Island | 243.0 ha | 4 000 - 5 000 | 11 |
| Forsyth Island | 80.0 ha | 15 000 - 25 000 | 91 |
| Goose Island | 97.6 ha | 500 - 1 000 | 3 |
| Swan Island | 247.0 ha | 150 - 250 | 3 |
| Waterhouse Island | 208 ha | 200 - 300 | 5 |
| Low Head Peninsula | 2.0 km | 450 - 650 | 682 |
| Hawley Point | 1.5 km | 2 000 | 103 |
| Greens Beach | 1.2 km | ? | 27 |
| East Sandy Point | 1.5km | ? | 3 |
| Bellbuoy Beach | 1.5 km | ? | 2 |
| Bakers Beach | 7 km | ? | 4 |
| Other localities | - | ? | 9 |
| King Island* | - | - | 4 |

*Four penguins collected from King Island were later found to be oiled from a source other than the *Iron Baron* addition the occurrence of the oil spill in the pre-breeding season significantly reduced the mortality of oil-affected species by not involving eggs or chicks and avoided the necessity of hand rearing. Even so, by mid August little penguins were laying eggs on Ninth Island and females in the rehabilitation facility at Low Head were developing brood patches.

## REHABILITATION PROCESS

After a few days of crisis management the rescuing and rehabilitation of oiled wildlife was structured under an Incident Control System or ICS. This management system can be adapted for any large scale disaster, such as bushfire or flood, where staff and materials need to be mobilised quickly and effectively. BHP's commitment to fund the rescue operation meant that materials and personnel were quickly mobilised statewide and nationally to establish a well appointed rehabilitation facility at the historic Pilot Station, Low Head. The rehabilitation program commenced on 11 July 1995 and was completed by the 29 August, a total of 50 days later.

A series of critical assessment and treatment phases for rehabilitating oiled wildlife were developed at Low Head. These aimed at providing short term housing and professional husbandry procedures which minimised damage, stress and the likelihood of disease to captive wildlife. Procedures generally followed the guidelines prescribed by Walraven (1992), i.e. banding, veterinary care, washing, drying and rehabilitation. However, specific techniques were developed on site and refined during the spill. Details of these techniques will be published seperately.

Staff from the Parks and Wildlife Service, University of Tasmania, Antarctic Division and over fifty professional zoo keepers, vet nurses, veterinarians and wildlife biologists from around Australia assisted in the operation. Mainland staff came from Melbourne, Adelaide and Taronga Zoo, Sea World, Healesville Sanctuary, Currumbin Sanctuary, Phillip Island Penguin Reserve, Queensland and New South Wales National Parks and the Northern Rivers Seabird Rescue Unit. In addition, Curt Clumpner from the International Bird Rescue Research Centre in Berkeley California, who has participated in more than 25 global oil spills, was employed as an expert in washing oiled seabirds. All staff were ably assisted by a large number of volunteers, mainly local residents, and collectively they provided expert wildlife care and guidance on procedures. Throughout the rehabilitation process alone over 160 personnel were involved with feeding, cleaning and swim testing birds.

## SUCCESS OF THE OPERATION

While the *Iron Baron* oil spill did not involve the rehabilitation of diverse species of wildlife or the loss of comparatively large volumes of oil, like the *Exxon-Valdez* in Alaska, there is no doubt that the impact of the oil on the Tasmanian environment was significant. The most likely fate of any oiled seabird is death within a few days and in most cases the body sinks at sea (N. Brothers and R. Gales pers. comm. 1995). While a team of researchers are currently calculating the real loss of wildlife from the spill, early predictions are that many thousands of individuals have been lost.

In terms of numbers of wildlife rescued and rehabilitated the operation was a huge success. Of the 2 063 little penguins collected over 95% were treated and released with good expectations for their survival. In the 1994 oil spill in Cape Town South Africa for example, more than 9 600 jackass penguins were rescued but about 3 000 died within the first 24 hours of the spill. The success of this Tasmanian operation can be attributed to the professional execution of tasks by a variety of individuals. The dedication of volunteers, keepers, veterinarians, support staff, advisers and ICS controllers alike ensured that the rehabilitation centre ran without major incident. The resourcing of the facility by BHP, Temco, Parks and Wildlife Service, George Town Council and local benefactors was essential to the operation and without which the quality of care could not have been provided.

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# VARIATION IN LEAF SHAPE OF *HAKEA EPIGLOTTIS*

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## INTRODUCTION

*Hakea epiglottis* Labill. is a Tasmanian endemic species, which typically grows as a shrub or small tree, and occurs from sea level to high altitudes. The distribution map in Brown *et al.* (1983) shows it to be most widespread in the east, south and west of the State, and least common in the north. In eastern Tasmania, *H. epiglottis* is often associated with insolated or exposed sites on dolerite, including rock plates, gorges and coastal landforms.

*Hakea epiglottis* is common in coastal landforms on the Tasman Peninsula. During a survey of *Euphrasia amphisysepala* habitat on Dolomieu Point, within Abel Tasman Forest Reserve, *H. epiglottis* was found growing in two distinct habitats. Close to the waterline, on relatively exposed rock slabs, cliffs and ledges, *H. epiglottis* grows as a semi-prostrate shrub. Its wind-twisted stems emerge from crevices where soil and moisture accumulate and some protection from the elements is provided. Immediately upslope from the coastal fringe, on south-facing slopes where the microclimate is less severe and a veneer of soil is present, a dense scrub has developed. The scrub may have originated after a wildfire which burnt much of Dolomieu Point in the early 1980's. Common scrub species include *Bedfordia salicina, Callistemon pallidus, Leptospermum scoparium* and *H. epiglottis,* in this case growing as an erect shrub to a height of 4m.

Leaves of *H. epiglottis* at Dolomieu Point varied greatly in their morphology. Curtis (1963) describes the leaves of the species as "terete (i.e. cylindrical), rigid, mucronate and pungent (i.e. with a needle-like point), often curved upward, 2-10cm long". All shrubs observed in the exposed coastal habitat at Dolomieu Point had leaves which were consistent with this description. However, leaves of *H. epiglottis* in the dense scrub varied from terete, rigid leaves as described by Curtis (1963), to flat, linear-lanceolate leaves which were far from rigid. Trends in leaf form seemed to relate to their position on the stem.

This paper documents the variation in leaf morphology of *H. epiglottis* at Dolomieu Point, and speculates on reasons for this variation.

## METHODS

Several branches of *H. epiglottis* were collected from the scrub environment, and one branch was collected from a crevice near the waterline (i.e. coastal environment). Four branches from the scrub plants were selected for measurements of leaf dimensions; these branches all contained a range of leaf forms. The selected branches contained apical leaves (growing near branch tips at the top of the canopy), mid-stem leaves (growing in middle sections of branches within the canopy) and basal leaves (growing towards the base of branches, below the canopy). Similar measurements were made on apical, midstem and basal leaves on the branch from the coastal environment. An average of 16 leaves were randomly selected and measured from different sections of each branch of the scrub plants, and 11 leaves were measured from the coastal plant. The t-test for independent samples was used to compare:

- leaf morphology in different sections of the scrub plant branches;
- leaf morphology in different sections of the coastal plant branch;
- leaf morphology in plants growing in the two environments.

All specimen sheets of *H. epiglottis* in the Tasmanian Herbarium (about 100 sheets in all) were examined to see if the range of leaf variation observed at Dolomieu Point occurred elsewhere in the State. Fourteen of the specimen sheets were from Tasman Peninsula, most of the plants being collected from coastal or near-coastal environments. Specimens of most other Tasmanian species of *Hakea* (*H. lissosperma*, *H. microcarpa*, *H. teretifolia*, *H. nodosa*, *H. sericea* and *H. ulicina*) were also examined to see if other species had comparable variation in leaf morphology.

## RESULTS

*Leaf morphology of* Hakea epiglottis *from Dolomieu Point*

Basal and mid-stem samples were grouped for both scrub and coastal specimens as length and breadth of leaves did not differ significantly between these leaf positions.

For scrub plants, length of leaves was not significantly different between the apical and mid-stem/basal positions. However, breadth of leaves was significantly greater for the mid-stem/basal position compared to the apical position ($t=-8.7$, $df=60$, $p<0.001$; Table 1). Apical leaves were mainly terete, and matched the description given in Curtis (1963), but some were distinctly flattened. Leaves were much more crowded towards the tip of the branches, and became progressively sparser towards their bases. Midstem and basal leaves were occasionally terete, but mainly flattened, with the widest leaf measurement being 6 mm. The flattened leaves had markedly thickened midribs and margins, were widest towards their tip and narrowed towards the petiole (Fig. 1).

For the coastal plant, breadth and length of leaves was the same regardless of leaf position. All leaves were terete, rigid and pungent (Fig. 1), as described by Curtis (1963). Leaf density was similar on all sections of the stem. The breadth of mid-stem/basal leaves was significantly different between coastal and scrub specimens ($t>3.7$, $df=27$, $p<0.001$; Table 1). However, breadth of apical leaves

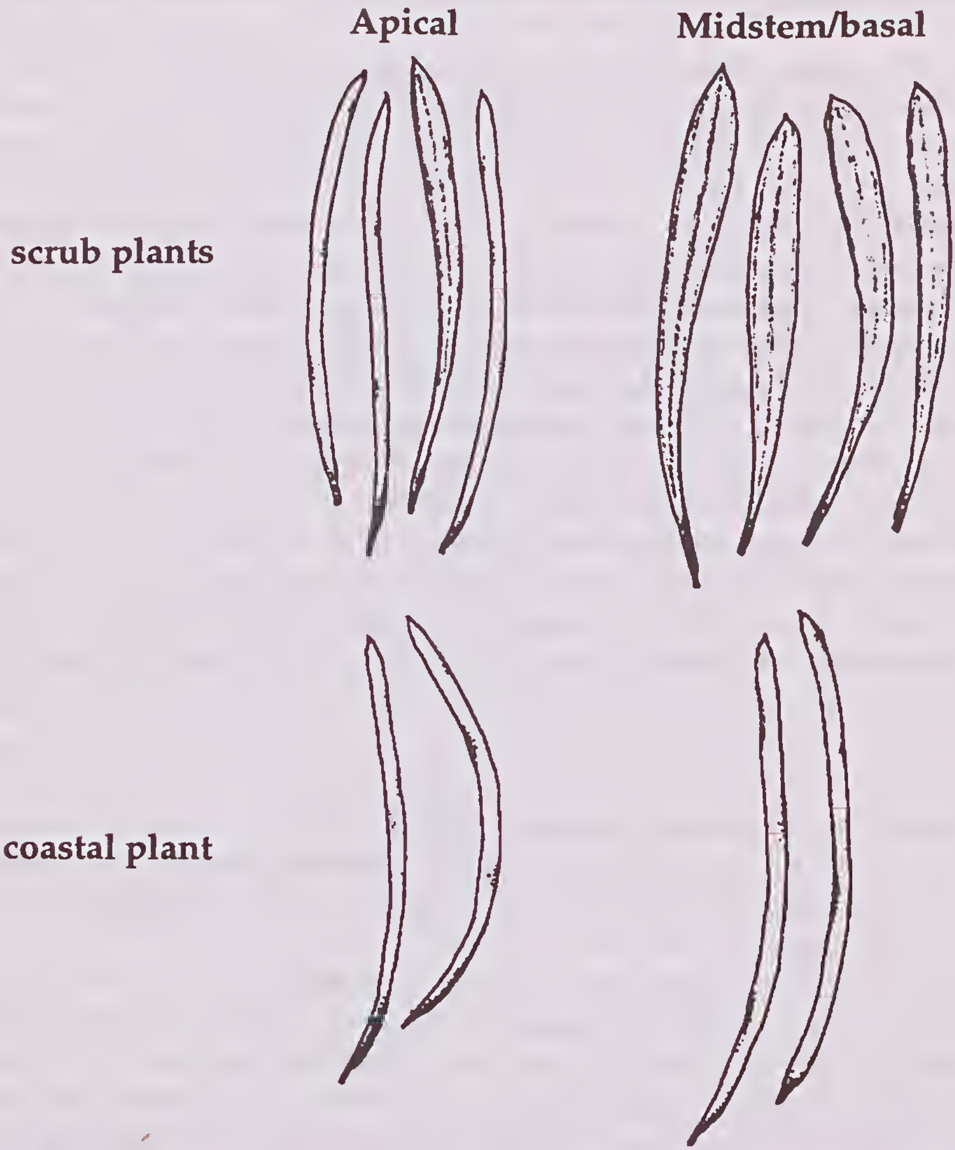


Fig. 1. Examples of leaves of *Hakea epiglottis* from Dolomieu Point.

was not significantly different between coastal and scrub plants. Length of apical and mid-stem/basal leaves did not differ between coastal and scrub plants.

*Comparisons of Dolomieu Point and herbarium specimens*

All leaves of the herbarium specimens of *H. epiglottis* were terete, rigid and pungent, irrespective of their position on the branches. Considerable variation was evident in some other leaf characteristics. Width varied from less than 1 to 3 mm. Length varied from 15 to over 200 mm. Long leaves tended to have

**Table 1. Leaf characteristics (Mean±SD, in mm) for *H. epiglottis* from Dolomieu Point.**

| | apical position | mid-stem/basal position |
|---|---|---|
| Scrub plants | | |
| length | 7.28±1.76 | 7.47±1.91 |
| breadth | 0.22±0.10 | 0.48±0.13 |
| sample size | 40 | 22 |
| Coastal plants | | |
| length | 6.33±1.40 | 7.11±1.96 |
| breadth | 0.20±0.00 | 0.20±0.00 |
| sample size | 4 | 7 |

narrower diameters. Specimens with very short leaves had invariably been collected from exposed sites, both in coastal environments (e.g. Cape Raoul) and at high altitudes.

Specimens of *H. lissosperma*, *H. nodosa*, *H. teretifolia*, *H. microcarpa* and *H. sericea* all had leaves which were terete or near-terete, as described in Curtis (1963). *Hakea ulicina*, a species confined (in Tasmania) to the Furneaux Group, had flat, linear leaves on all specimens examined. The key to *Hakea* species in Curtis (1963) separates *H. ulicina*, from the other Tasmanian species, on the basis of its flat leaves.

## DISCUSSION

The great difference in form between plants growing on the coastal rock slab and plants growing in the scrub (less than 50m away) can be attributed to influences of the physical and biological environment. On the rock slab, exposure to wind, spray and drought, and the absence of competition from other shrubs, has encouraged a low, spreading habit. The development of dense scrub, further back from the waterline, has encouraged an erect growth habit in shrubs (of all species) because of competition for light. Not surprisingly, very few seedlings were present under this canopy. Regeneration of shrub species would depend on fire occasionally removing the canopy, and providing a receptive seed bed for seed released from the protective capsules of fire-killed shrubs (e.g. *H. epiglottis*, *Leptospermum scoparium*), or seed disseminated from unburnt vegetation in the area (e.g. *Bedfordia salicina*). The latter might include seed from rock slab (coastal) *H. epiglottis* plants, which would be relatively protected from fire by expanses of bare rock.

The flattened *H. epiglottis* leaves growing under the dense scrub canopy at Dolomieu Point seem to be atypical, even though the species demonstrates variability in other aspects of leaf morphology (particularly length). Relatively low light levels under the dense shrub canopy are the most likely explanation for the development of wider leaves on lower (shaded) sections of the stems of scrub plants. Flattened leaves would increase leaf area available for photosynthesis. At the same time, amelioration of the climate under the canopy would lessen the usefulness of the terete and rigid apical leaves, which would better tolerate the more severe climate at the top of the canopy. Experimental treatments might show whether this response is phenotypic (i.e. directly attributable to the environment) or genotypic (i.e. resulting from natural selection over several generations). There are many examples in the literature of selection for genetically different forms over very short distances, and the ability to make plastic responses can itself be genetically determined (Brown 1983).

The tendency of leaves to reduce surface area in response to drought or exposure, and to increase surface area in response to shade or high moisture levels, can be seen in many Tasmanian woody taxa, both mesophytic (e.g. *Tasmannia lanceolata*, *Bedfordia salicina*, *Nothofagus cunninghamii*) and xerophytic or sclerophyllous (e.g. *Telopea truncata*, *Eucalyptus vernicosa*). However, in most cases, leaves on these plants respond more or less similarly to such environmental influences, rather than exhibiting the marked heterophylly which occurred in *H. epiglottis* in the scrub community at Dolomieu Point.

The review of herbarium specimens suggests that the heterophylly at Dolomieu Point is very uncommon, if not unique. However, specimen notes indicate that most of the specimens were collected from fairly open and often exposed environments. It would be interesting to determine, by field observations or experiment, if other populations of *H. epiglottis* respond to different levels of exposure, insolation or light, in a similar manner to plants at Dolomieu Point.

## ACKNOWLEDGEMENTS

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# THE PLATYPUS ON KING ISLAND

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The platypus (*Ornithorhynchus anatinus*) is one of Australia's best known and most unique native mammals. It has a wide latitudinal range along Australia's eastern seaboard including southern Victoria and Tasmania (Carrick 1983). King Island (144°E 40°S) holds a little-known and isolated population of the platypus (Campbell 1888, Green and McGarvie 1970, Rounsevell *et al.* 1991). With an area of around 1100 km$^2$, King Island lies in Bass Strait, about 80 km north-west of mainland Tasmanian. The species has not been recorded from Flinders Island (1330 km$^2$) in eastern Bass Strait nor are other natural island populations known. This note records some local knowledge of the distribution of platypus on King Island, very little of which has to date been documented in the literature (e.g. Grant 1984, Fleay 1980, Rounsevell 1989).

The platypus distribution given in Rounsevell *et al.* (1993) for King Island shows the presence of the species in one 10x10 km grid square covering the lower reaches of the Ettrick River in the south-west of the island. Platypus have, in fact, been regularly seen in the catchments of Sea Elephant and Ettrick Rivers, as well as all significant catchments south of these including farm dams, Big Lake and Collier's Swamp (McGarvie, pers. comm.). Conversely, regular observation, through for example extensive eel harvesting, of more northerly streams and lakes (e.g. Yellow Rock River catchment, Lakes Flannigan and Martha Lavinia) has not resulted in any sightings. Thus about half of the island appears to be occupied by platypus.

King Island generally receives a mean annual rainfall of around 900-1000 mm while Flinders Island receives around 730-780 mm (Bureau of Meteorology, Hobart). Monthly rainfall on King Island is higher between April and October inclusive. Local farmers consider 600 mm annual rainfall as drought years so precipitation appears to be reliable on a long-term basis. While named rivers occur on both islands, stream lengths are generally less than 30 km, and streamflow is not high by mainland standards. Biogeographic evidence such as the examination of amphibian faunas by Littlejohn and Martin (1965) has lead to the conclusion that the western islands in Bass Strait have a wetter history than those to the east.

The region of King Island apparently occupied by platypus is characterised by a more pronounced relief, including a plateau area above 100 m asl and the island's highest point at 160m asl. Soil type (and thus burrow potential) also varies with clay and loam substrates predominating within the known platypus range and loose sandy soils elsewhere. Differences in pressures on the population between King Island and that on the nearby Tasmanian mainland include the absence of the water rat (*Hydromys chrysogaster*) on King Island (Green and McGarvie 1970) and the absence of humans prior to European settlement. Low level predation on platypus by aboriginals has been recorded (summarised in Grant 1992) and water rats are conceivably burrow predators.

Stream length within the range of the King Island platypus was estimated from the 1:250 000 map to be 300 km. If this stream length is doubled to allow for smaller tributaries and an average stream width of 3 m is assumed, this provides a total streambed area of 180 ha. Lake and swamp habitat may add a further 400 ha. Population density estimates for platypus on King Island or Tasmania are unavailable. However, for an Australian mainland population adult male home range was estimated at 2.45 to 15.45 ha (Gust and Handasyde 1995), with evidence for exclusive male home ranges in the breeding season. If these density figures are applied to King Island using the estimated area of available habitat, a maximal population size of around 240 males is obtained. This would put the King Island platypus population close to the theoretical minimum viable population size (Caughley 1994), even though it has been isolated for at least 10 000 years.

Potential threats to platypus habitat include intensive stream modification, chemical runoff, and fish netting and trapping (Carrick 1983). In areas such as King Island the clearing of streamside vegetation and the trampling of stream banks by stock, especially along shallow streams, is also of concern. The potential for habitat degradation is exacerbated due to the predominance of private ownership of river frontage in Tasmania, and thus the absence of streamside reserves, compared with some other parts of Australia. The uniqueness of the King Island platypus population warrants a program of ongoing habitat monitoring and management.

## ACKNOWLEDGEMENTS

We would like to thank Max McGarvie and John Cross for their observations of platypus on King Island.

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# VERTEBRATES OF LAMBERT PARK / SKYLINE RESERVE ON MT. NELSON IN SOUTHERN TASMANIA

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## INTRODUCTION

Some 35 years ago when describing the context of Porter Hill on Mt. Nelson Guiler (1958) stated that "the bush on the western side ... extends up to Mt. Wellington. This bush is broken by two roads and there is very little cultivated ground. Beyond Mt. Wellington the country is undeveloped and uninhabited." Much urban settlement including the suburbs of Mt. Nelson, Ridgeway and Ferntree, and the Southern Outlet freeway, have subsequently been interposed into Guiler's expanse. However, much bushland still persists in the area. One such area which retains its original vegetation is Lambert Park / Skyline Reserve, 3.5km southeast of Hobart's GPO. The area is comprised of one of the northerly drainage systems of Mt. Nelson which reaches its outfall in the lower Derwent Estuary after some four kilometres. The upper three km of this gully system, the principle subject of this study, is often steep with about 300 m of fall along the rivulet and associated steep side slopes. Jurassic dolerite substrates occupy the upper catchment, a slightly unusual situation in the Hobart district where Permian mudstone and Triassic sandstone are also common foothill substrates.

This study reports on vertebrates found in Lambert Rivulet-Skyline Reserve by Tasmanian Field Naturalists' Club members (Tas. Field Nats.) and other local naturalists. This survey afforded an opportunity both to contribute to our knowledge of faunal communities in an area adjacent to urban areas, and to suggest management strategies for both Lambert Gully and adjacent areas for which a variety of urban planning strategies are under active consideration (Jill Hickie, Hobart City Council, pers. comm.).

## STUDY AREA

The core of the study area, on the upper slopes of Mt. Nelson, is comprised entirely of soils derived from Jurassic dolerite. The area is generally of high relief although knolls do occur. The vegetation varies significantly with aspect and drainage. Easterly and southerly aspects and the deeper gullies and lower valleys are dominated by *Eucalyptus globulus*, with *E. viminalis* and sometimes *E. pulchella* closed wet forest with an undergrowth of wet sclerophyll shrubs and smaller trees. In poorly drained areas *E. ovata* dominates. Northerly and north westerly aspects above the gully floor are dominated by grassy *E. pulchella* woodland and dry sclerophyll shrubs and trees. Rocky outcrops and boulders, including occasional areas of scree, occur on the slopes.

Urban areas abut the reserve on all sides except for about a km on the south eastern boundary which adjoins privately owned bushland on the upper northern slopes of Mt. Nelson. This includes a section of the Lambert Gully catchment in the Rialannah Road area.

The four areas trapped were as follow:

Site 1 was comprised of poorly drained flats and streamside vegetation at the head of the main westerly tributary gully, accessed from behind the church near the corner of Rialannah and Nelson Roads. *Eucalyptus ovata* dominates the flats, with a shrubby layer of *Leptospermum lanigerum* and *Erica lusitanica*. Grasses and sedges are also prevalent. Vegetation in the gully proper is comprised of *Eucalyptus globulus* with wet sclerophyll shrubs and smaller trees. On the steep northerly and north westerly slopes near the head of the gully, the vegetation rapidly grades into drier *E. pulchella / Allocasuarina verticillata* woodland with dry sclerophyll shrubs and trees. Some large areas of exposed dolerite outcrop occur.

Site 2 contained *E. globulus* wet forest. With its south-easterly aspect, this site is clearly more humid and cooler than the opposite side of the valley, with little herb-layer vegetation and damp leaf litter frequent at ground level. Exposed dolerite outcrops occur together with patches of scree. This habitat grades into an area of riparian *Bedfordia* scrub free of eucalypts (Peter McQuillan pers. comm.) which was not sampled in this study.

Site 3 was located on steep slopes with a north-westerly aspect. The vegetation was dominated by *E. pulchella / Allocasuarina verticillata* woodland with dry sclerophyll shrubs and trees and some large exposed dolerite outcrops.

Site 4 was located on a flattish knoll with less steep northerly and north westerly slopes than site 3. The vegetation was dominated by *E. pulchella* woodland with a thick *Poa / Themeda* grassy / sedgey layer, and occasional dry sclerophyll shrubs. Exposed dolerite was present as flattish outcrops and exfoliated flakes.

Much of the study area, and particularly the drier areas, appears to have been subject to infrequent and / or low intensity fire, as evidenced by the mature open trees and well developed low vegetation and leaf litter. The previous extensive fire in the area occurred around 10 years ago.

The weeds *Erica lusitanica* and *Cotoneaster* sp. are primarily present at sites 1 and 2, and *Chrysanthemoides monoliferum* is occasional at sites 3 and 4. All areas appeared to have a wealth of rocky crevices which provide suitable refuges for small vertebrates. Site 3 and site 4 in particular had many hollows in the burnt out bases of trees. Some hollow development was also evident higher in trees but was not quantified.

## METHODS

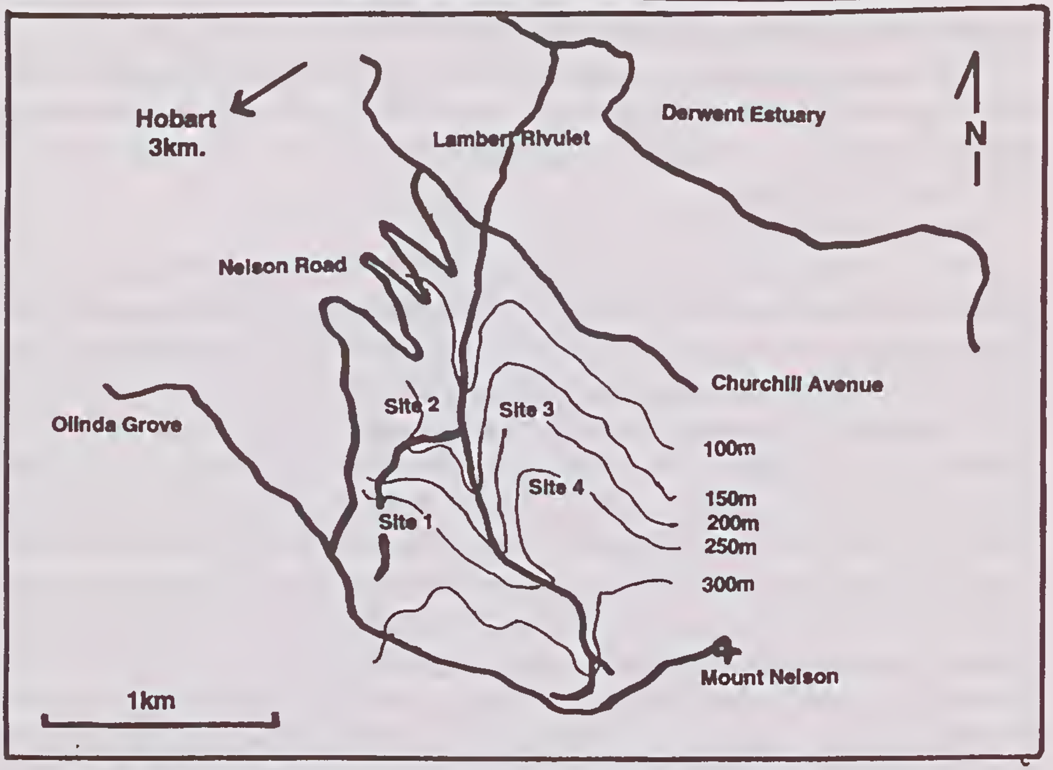


Fig. 1. Location of the study area showing the four sites trapped.

*Prior Records*

Vertebrate records were sought for the general Lambert Rivulet area from the TasPaws flora and fauna database maintained by the Parks & Wildlife Service. Naturalists known to have knowledge of the area were contacted and their results are included as acknowledged. A list of reptile and amphibians were provided by Andrew Hingston (a Tas. Field Nats. member) from a survey over the summer of 1993/94 in an area across Olinda Grove to the southwest of the present study area. His methodology included sight records, examination of live specimens from under stones and logs and identification of frogs from their calls. Occasional records were provided by other observers as noted. Bird sightings were provided by Andrew Hingston, Denis Abbott, a B.O.A.T. member and long-term resident of Rialannah Road adjacent to the upper end of Lambert Reserve, and Murray Lord, who has lived for 10 years near the lower end of the reserve. Occasional records were provided by others as noted.

*Mammal Survey*

Trapping of mammal survey was undertaken in October 1994 using Elliott small-mammal traps (0.35 x 0.1 x 0.09m) and wire cage treadle traps (0.55 x 0.2 x

0.2m). Small mammal traps were baited with an amalgam of peanut butter and rolled oats, cages with peanut butter spread on potato. At Sites 1, 3 and 4, 20 cages and 50 Elliott traps were deployed over each of three nights. At Site 2, on the first night 12 cages and 25 Elliotts were deployed, and 20 cages and 50 Elliotts both subsequent nights. This gave a total of 232 cage and 575 Elliott trap nights. Traps were laid out on two transects 50 m apart. Each transect had 10 cages deployed about 20 metres apart and two or more Elliott traps within 3 metres of each cage. Trap lines were selected to represent the major apparent variations in habitat. Their location is indicated in Fig. 1. Mammals were also assessed from indirect evidence such as tracks and signs and from direct sighting.

## RESULTS

### *Reptiles and Amphibians*

Two frogs and eleven species of reptiles were recorded by A. Hingston in an adjoining area. These are brown tree frog *Litoria ewingi* , common froglet *Ranidella signifera*, mountain dragon *Tympanocryptus diemensis*, she-oak skink *Cyclodomorphus casuarinae*, White's skink *Egernia whitei*, delicate grass skink *Lampropholis delicata*, Duperrey's skink *Bassiana duperreyi*, grass skink *Pseudomoia entrecasteauxii*, metallic skink *Niveoscincus metallicus*, blotched blue-tongued lizard *Tiliqua nigrolutea*, white-lipped snake *Drysdalia coronoides*, copperhead snake *Austelaps superbus* and tiger snake *Notechis scutatis*. The snakes, the blotched bluetongue, some of the skinks and the mountain dragon are also present at Porter Hill (D. Hird, unpublished data).

### *Birds*

Sightings made by Andrew Hingston, Denis Abbott and Murray Lord form the basis of the list of birds from the study area given below, unless otherwise indicated. Introduced species are denoted by an asterix before their name.

White-faced Heron *Ardea novaehollandiae*. Present at Mt. Nelson Oval for weeks in the winter of 1982, one near Hutchins School oval recently.

Brown Goshawk *Accipiter fasciatus*. Successfully nested in Lambert Creek Gully in 1992/93, below Bend 6, occasional other records.

Collared Sparrowhawk *Accipiter cirrhocephalus*. Uncommon visitor.

Grey Goshawk *Accipiter novaehollandiae*. Rare visitor.

White-bellied Sea-Eagle *Haliaeetus leucogaster*

Wedge-tailed Eagle *Aquila audax*

Marsh Harrier *Circus aeruginosus*. Not seen for years, probably only overflying the area.

Peregrine Falcon *Falco peregrinus*. Rare visitor.

Brown Falcon *Falco berigora*. Regularly seen over Proctors Rd/Olinda Rd area.

Brown Quail *Coturnix australis*. Seen occasionally.

Lewin's Rail *Rallus pectoralis*. One caught in mammal-trap-cage at Porter Hill in July 1994 by D. Hird.

Masked Lapwing *Vanellus miles*. Present on ovals.

*Spotted Turtle-Dove *Streptopelia chinensis*.

Brush Bronzewing *Phaps elegans*. Has bred in the gullies (Lambert Creek). Occasionally appears in Rialannah Road.

Yellow-tailed Black-Cockatoo *Calyptorhynchus funereus*. Comes into the area at different times during the year, probably from higher up Mt Wellington.

Swift Parrot *Lathamus discolor*. Seasonal, in spring/summer. Numbers fluctuate year to year depending on eucalypt blossom.

Green Rosella *Platycercus caledonicus*. Year round resident

Eastern Rosella *Platycercus eximius*. Seen regularly around Lambert Park, not found on top of Mt. Nelson.

Pallid Cuckoo *Cuculus pallidus*. Seasonal in spring/summer. Breeds on Mt. Nelson.

Fan-tailed Cuckoo *Cuculus pyrrhophanus*. Seasonal in spring/summer, occasionally one or two overwinter.

Shining Bronze-Cuckoo *Chrysococcyx lucidus*. Regular summer visitor but in low numbers.

Southern Boobook *Ninox novaeseelandiae*. Usually heard, sometimes seen, every year.

Masked Owl *Tyto novaehollandiae*. Occasional reports, seen at Porter Hill 1990 by D. Hird.

Tawny Frogmouth *Podargus strigoides*. Resident.

Australian Owlet-nightjar *Aegotheles cristatus*. Two probable records of birds calling in Lambert Park in mid 1990s, also Rialannah Road in 1993.

White-throated Needletail *Hirundapus caudacutus*. Flocks seen in flight on humid days, February/March.

*Laughing Kookaburra *Dacelo novaeguineae*. First seen in Lambert Park in mid 1980s, now seen reasonably regularly.

Welcome Swallow *Hirundo neoxena*. Seasonal in spring/summer.

Tree Martin *Cecropis nigricans*. Seen occasionally in spring/summer.

Black-faced Cuckoo-shrike *Coracina novaehollandiae*. Seasonal in spring/sumer. Breeds on Mt. Nelson.

White's Thrush *Zoothera dauma*. Also seen at Porter Hill by D. Hird.

*Blackbird *Turdus merula*. Throughout the year. Has been ncreasing as more houses are built and lawns added.

Pink Robin *Petroica rodinogaster*. Seen regularly in Lambert Park in 1960 by D. Milledge who found them breeding. Not seen there in last 15 years.

Flame Robin *Petroica phoenicea*. Not seen for some years, present in the spring of 1983.

Scarlet Robin *Petroica multicolor*. Present throughout the year.

Dusky Robin *Melanodryas vittata*. Occasional visitor.

Olive Whistler *Pachycephala olivacea*. Seen occasionally above Lambert Park, prefers dense habitat.

Golden Whistler *Pachycephala pectoralis*. Present throughout the year.

Grey Shrike-thrush *Colluricincla harmonica*. Present throughout the year.

Satin Flycatcher *Myiagra cyanoleuca*. Seasonal in spring/summer.

Grey Fantail *Rhipidura fuliginosa*. Present throughout the year, breeds in area.

Superb Fairy-wren *Malurus cyaneus*. Present hroughout the year, breeds in area.

White-browed Scrubwren *Sericornis frontalis*. In gullies, Truganini Reserve track, and Lambert Park.

Brown Thornbill *Acanthiza pusilla*. Present throughout the year.

Yellow-rumped Thornbill *Acanthiza chrysorrhoa*. Not seen since 1983. (In grassland on Rialannah Road. Area where they were usually seen has now been built on.)

Tasmanian Thornbill *Acanthiza ewingii*.

Yellow Wattlebird *Anthochaera paradoxa*. Present throughout the year, breeds in area.

Little Wattlebird *Anthochaera chrysoptera*. Found in Lambert Park, but not further up hill.

Noisy Miner *Manorina melanocephala*.

Yellow-throated Honeyeater *Lichenostomus flavicollis*. Present throughout the year.

Strong-billed Honeyeater *Melithreptus validirostris*. Seen occasionally through the year.

Black-headed Honeyeater *Melithreptus affinis*. Present throughout the year, breeds in area.

Crescent Honeyeater *Phylidonyris pyrrhoptera*. Seasonal in autumn/early spring.

New Holland Honeyeater *Phylidonyris novaehollandiae*. Throughout the year, breeds in area.

Eastern Spinebill *Acanthorhynchus tenuirostris*. Seasonal in autumn/winter.

Spotted Pardalote *Pardalotus punctatus*. Present throughout the year.

Forty-spotted Pardalote *Pardalotus quadragintus*. Occasional records in 1960s, seen regularly above Lambert Park in last five years, but only up to three birds.

Striated Pardalote *Pardalotus striatus*. Seasonal in spring/summer.

Silvereye *Zosterops lateralis*. Throughout the year, breeds in area.

*European Goldfinch *Carduelis carduelis*. Present throughout the year.

*European Greenfinch *Carduelis chloris*. Present in small numbers, only on lower slopes.

*House Sparrow *Passer domesticus*. Present throughout the year. Not noticed as much lately.

Beautiful Firetail *Emblema bella*. Last seen at the top of Lambert Gully in 1981. Used to be seen in the area near the Signal Station. Occasionally seen in recent years near Bend 2. Also observed at Porter Hill by D. Hird.

*Common Starling *Sturnus vulgaris*. In patches, not as widespread as Blackbirds but numerous and probably increasing, breeds in area.

Dusky Woodswallow *Artamus cyanopterus*. Seasonal in spring summer. Uncommon, most often seen in woodland near summit of Mt. Nelson.

Grey Butcherbird *Cracticus torquatus*. Present through the year, but noticed more in the autumn.

Black Currawong *Strepera fuliginosa*. Seen for the first time late winter-early spring 1994.

Grey Currawong *Strepera versicolor*. Mainly autumn-spring. Presence increased in recent years. Only recorded down as far as Lambert Park in 1994. Have nested in area.

Forest Raven *Corvus tasmanicus*. Present throughout the year.

A masked owl was observed at Porter Hill in 1990 (D. Hird, unpubl. data) and hence this species may also be present in the study area.

*Mammals*

Numbers of each mammal species caught at each of the four sites trapped (see Fig. 1) are given in Table 1. No small mammal records (body weight less than 200g.) are known from the study area other than those recorded in Table 1. Thus *Cercartetus lepidus*(little pygmy possum), *Antechinus spp*, and *Sminthopsis leucopus*(small marsupial carnivores), native rodents other than the velvet-furred rat *Rattus lutreolus*, and the house mouse *Mus musculus* are unrecorded from the area. At Porter Hill the introduced Norway rat *R. norvegicus* and house mouse inhabit disused pasture areas, with black rats *R. rattus* naturalised in bushland areas also occupied by native velvet rats (D. Hird, unpublished data). *Antechinus swainsonii* was recorded at Porter Hill in 1950 (Guiler 1958).

Echidnas *Tachyglossus aculeatus* are regularly sighted in the general area (A. Hingston and D. Abbott, pers. comm.). Brushtail possums *Trichosurus vulpecula* are apparently common and widespread, both from trapping results and scats. Ringtail possum *Pseudocheirus peregrinus* dreys (woven nests) were seen (unoccupied) in Site 1. Of the potoroids ("rat-kangaroos"), the long-nosed potoroo *Potorous tridactylus* was common and widespread. Bettongs *Bettongia gaimardi* were less common and only encountered in the dry grassy woodland of

**Table 1. Numbers trapped and rates of captures (per 100 trapnights) for mammals from Lambert Rivulet / Skyline Reserve.**

For rats trapnights includes both Elliott and cage traps, for other species cages only. Site 1 was a swampy flat, site 2 was situated on a north-facinglope, site 3 on a south-facing slope and site 4 on a grassy knoll. CR = capture rate.

| Species | Site 1 | | Site 2 | | Site 3 | | Site 4 | | All Sites | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | CR | No. | CR | No. | CR | No. | CR | No. | CR |
| Barred Bandicoot | 1 | 1.7 | 0 | 0 | 0 | 0 | 2 | 3.3 | 3 | 1.3 |
| Brown Bandicoot | 2 | 3.3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.9 |
| Long-nosed Potoroo | 14 | 23.3 | 14 | 26.9 | 4 | 6.7 | 4 | 6.7 | 36 | 15.5 |
| Eastern Bettong | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3.3 | 2 | 0.9 |
| Brushtailed Possum | 3 | 5.0 | 1 | 3.9 | 8 | 13.3 | 7 | 11.7 | 19 | 8.2 |
| Velvet-Furred Rat | 4 | 1.9 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0.5 |
| Black Rat | 0 | 0 | 0 | 0 | 1 | 0.5 | 1 | 0.5 | 2 | 0.2 |

Site 4. Both Tasmanian bandicoot species were trapped in low numbers. The brown bandicoot *Isoodon obesulus* was only encountered in the wetter Site 1, while barred bandicoots *Perameles gunnii* were also trapped in the relatively dry Site 4. All of these species have been recorded in the last seven years at Porter Hill, although bettongs appeared there some four years ago after prior absence, and the barred bandicoot is represented by only two records from around 4 500 trap nights (D. Hird, unpublished data). The sugar glider *Petaurus breviceps* is unrecorded from this site, the nearest known record is Ferntree, 5km to the west (Taylor and McQuillan 1994). Overall capture rates for potoroos, bettongs, brown bandicoots and brushtail possum (Table 1) were less than recorded at Porter Hill (Hird 1994). Bandicoot diggings were observed in the area below Churchill Avenue, these may be attributable to barred bandicoots which have been seen in the area (Julia Scott, pers. comm.). Brushtail and ringtail possums are occasionally observed in surrounding suburbia.

The pademelon *Thylogale billardierii* and Bennett's wallabies *Macropus rufogriseus* and the wombat *Vombatus ursinus* are potential residents of the study area. However, no recent reliable records of any of these is known. None of the usually evident signs of their presence was noted. None of these species are reliably known closer to Hobart than Neika (Tas. Field Nats., unpubl. data). The introduced herbivores, the rabbit *Oryctolagus cuniculus* and hare *Lepus europaeus*, are, however, both present.

No records or signs were found of larger marsupial carnivores. An indication of the presence of quolls or the Tasmanian devil *Sarcophilus harrisii* is usually frequent depredation on fowl houses, but this is at most a very occasional event in the area (P. McQuillan, pers. comm.). Quolls were occasionally seen by residents of Porter Hill some 20 years ago (Joan Dorney, pers. comm.), and one eastern quoll *Dasyurus viverrinus* was trapped there three years ago (D. Hird, unpublished data). Devils are known from the fringes of Mt. Wellington in small numbers (Tas. Field Nats. unpubl. data).

Sightings of bats have regularly been reported from the area but the species involved are unknown. Denis Abbott (pers. comm.) found a roosting pair, though to be lesser long-eared bats *Nyctophilus geoffroyi*, in a garden shed near Rialannah Road.

Rabbits and hares are known from the study area (Denis Abbott, pers. comm.) and a rabbit was seen during field work, but only occasional dung piles were evident.

*Prior and New Records*

Prior records of four mammals and one bird from the study area were available. The results of this survey thus add two amphibian, 10 reptile, 63 bird and four mammal species to the native vertebrates known from the area, together with information about apparent habitat preferences within the area and capture rates.

## DISCUSSION

Assemblages of lowland wet and dry sclerophyll forest and woodland on Jurassic dolerite soils such as that of this study are not uncommon in southern Tasmania, but their characteristic faunas are not well documented and not well reserved, at least in an intact state. This study has thus afforded an opportunity to expand our knowledge of vertebrate community ecology in this context.

*Reptiles and Amphibians*

Reptile local faunas are not well documented in Tasmania, although a recent exception is Taylor *et al.* (1993). The richness of this fauna (10 of Tasmania's 19 mainland species) is of significance in this context, although it must be said that Tasmania's reptile fauna is depauperate when compared to the richness of mainland Australia's. The species present require several different microhabitats. For example, metallic skinks are often associated with logs, while the mountain dragon, she-oak skink, grass skink and White's skink are typically associated with sunny vegetation such as open woodland.

Amphibians are very likely to be more diverse than the two species recorded. *Ranidella tasmaniensis* and *Limnodynastes dumerili*, for example, are found nearby at Ridgeway (Tas. Field Nats. unpubl. data), the latter particularly close to permanent water.

*Birds*

Although Lambert Reserve's bird list is not spectacular, it is a valuable benchmark in its near-urban context. The birds present are generally characteristic of the habitat types represented. Of particular interest are forty-spotted pardalote records (although these would most likely be vagrant individuals), the nest records, and the richness of the list for a near-urban area. A small pocket of blue gum in the reserve is a food resource for the vulnerable swift parrot, particularly in the context of ongoing extensive forestry exploitation of this habitat. Some additional species not yet recorded may be present. For example, potential habitat for the scrubtit may be available in the deeper gully areas.

*Mammals*

Echidnas utilise a broad range of habitats in Tasmania, occurring over all but the highest altitudes. They also occur close to disturbed areas, as at Porter Hill (Guiler 1958, D. Hird unpubl. data). A somewhat peripheral record is of a platypus skull reported as having been found in a rats nest in a cellar in Sandy Bay (Marlborough Ave., close to an adjacent watercourse) some years ago, and lodged with the Tasmanian Museum (J.T. Rossiter pers. comm.). Platypus are known to cross ridges and utilise ephemeral streams and lakes in Tasmania (Burrell 1927), and first year mortality is high, possibly through dispersal (Grant 1984). The platypus is, however, not included in the Lambert Rivulet fauna list as the record is ephemeral and the habitat generally unsuitable.

The only native small mammal found was the velvet-furred rat *Rattus lutreolus*. Both the little and eastern pygmy possums are recorded from nearby Mountain Park (Taylor and McQuillan 1994), but are not easily detected by the methods used here. Their possible presence at Lambert Park is worth further investigation. The presence of a more diverse small terrestrial mammal fauna from the study area prior to European settlement is to be presumed. The loss of elements such as *Antechinus swainsonii* in bushland in near-urban areas appears to be the norm in southern Tasmania over a range of lowland habitats (Tas. Field Nats. unpubl. data), although the species occurs near disturbed habitats the Cygnet district (Owen Wilkins pers. comm.). For a population of *Antechinus swainsonii* on Mt. Wellington trapping success was 2.5% for the comparable time period during which trapping was conducted for this study (Hocking 1975). The chance of *Antechinus swainsonii* being present in the most likely habitat (Area 1) and *not* being detected is only 2.6%, based on binomial distribution probability. Predation by feral and ranging domestic cats, and possibly competition from introduced rodents, is suggested to be the most likely explanation for such losses.

The co-occurrence of four mycophagous (fungal feeding) marsupials (viz bettong, potoroo, and brown and barred bandicoots) does not appear to have been reported previously. At Porter Hill the same assemblage, usually less barred bandicoots, is currently present (D. Hird unpubl. data), and near Colebrook bettong populations were overlapped by uncommon potoroos and barred bandicoots (Johnson 1994). Habitats of the two bandicoots are usually cited as being distinguished by the undergrowth density with the barred bandicoot preferring open vegetation (Heinsohn 1966), including agricultural areas, and the brown bandicoot preferring areas of scrub and low ground cover (Watts 1993). However, the barred bandicoot was recently recorded in forested areas on the Wellington Range (Hird and Hammer 1995), and research is currently underway to further investigate habitat requirements for the species under Recovery Plans sponsored by the Australian Nature Conservation Agency (Driessen and Hocking 1991). The mosaic of forest and understoreys of differing densities, attributed here to soil moisture gradients, is suggested as the key factor in allowing overlap of these four species. The infrequency of reported overlap for these four species probably reflects of lack of systematic survey effort in Tasmania and the cryptic nature of the animals. Tasmanian potoroos are often assumed to frequent dense scrub and heath as they do on the Australian mainland (Lee and Cockburn 1983). However, the present study and other survey data (Tas. Field Nats. unpubl. data) indicate that more open vegetation nearby dense undergrowth are also inhabited in Tasmania.

The possums encountered are to be expected in this habitat. Most female brushtails caught carried back-young, consistent with the usual Tasmanian pattern of late autumn-births (Lyne and Verhagen 1957). The sugar glider, while unrecorded from this site, is known from Mountain Park (Taylor and McQuillan 1994) and the area is broadly comparable with habitat occupied on mainland Australian (Suckling 1983). The presence of sugar gliders would usually not be detected by the techniques used in this study. The characteristic incisions they make in smooth eucalypt bark were, however, not observed.

The apparent absence of larger herbivores seems characteristic of near-urban areas around Hobart (Tas. Field Nats. unpubl. data), even in habitats which further afield would be expected to support viable populations. Similarly, larger carnivores (eastern quolls and devils) seem now restricted to occasional vagrant individuals in near-urban areas. Disturbance from humans and from dogs is suggested as a primary reason for this substantive local demise.

Survey of the bat fauna was largely beyond the scope of this survey. However, bats were observed in the area. Studies in comparable areas of Tasmania indicate that most of the state's eight species of bat may occur here (Taylor and O'Neil 1986).

Rabbits were very evident from dunghills and diggings and occur as an insidious introduced species, as in most other habitats in eastern Tasmania.

*Management implications*

The area and shape of a reserve strongly influence its long-term viability, including vulnerability to potentially catastrophic events such as intensive fire. A literature discussing and analysing fauna conservation and management issues in fragmented and depleted habitats is developing, especially in the context of forest conservation (Bennett 1987, Possingham 1991, Kirkpatrick 1991, Burgman *et al.* 1993). Local species diversity tends to diminish with decreasing reserve size, and encroachment of weeds and other edge effects tend to increase with increasing boundary-length to area ratio, although the extent of neighbouring disturbance is also clearly significant. Diminishment of diversity may not immediately coincide with the isolation event. Current indentations in the Lambert Reserve boundary are of concern in this regard.

The proximity of Lambert / Skyline Reserve to Mt. Wellington is of significance, at least for mobile species such as birds which can easily traverse the intervening five km. Similarly, the south eastern boundary of Lambert / Skyline Reserve is currently continuous with bushland of various types extending through predominantly private land to Porter Hill, Truganinni Reserve and the Bonnet Hill range.

The occurrence of fire is a natural feature of drier forest ecosystems, especially in the context of their aboriginal history. Fire management strategies for vertebrates in Lambert Rivulet is a difficult issue from both the human habitation and biological viewpoints. The past fire regime has not been examined in detail here, but fire history has been suggested to be of significance to fungal-feeding marsupials (Taylor 1992) and total exclusion is probably not the most appropriate strategy. The subject more generally has been discussed by Fensham (1992).

Uncontrolled dogs and the walking of dogs may have affected the wallabies and larger carnivores, but the retention of the faunas documented here and at Porter Hill indicates that populations of some species are somewhat robust to disturbance and/or predation from this source on its present scale. More insidious threats include cats which are known predators on birds, immature bandicoots and some other medium-sized marsupials.. Blackbirds thrive in well-watered urban gardens, and encroach into bushland, while starlings are known to displace hollow-nesting birds. Effective solutions to these alien species are not readily available at present. Indigenous birds and mammals commensal with human activities may also increase in numbers and become local nuisances, eg ravens and currawongs as scavengers / nest robbers, and brushtail possums. Involvement of the local community may be useful in monitoring and managing the reserve although increased usage may also be deleterious in particular areas.

## CONCLUSIONS

Despite being situated only 3.5km from Hobart's GPO, Lambert / Skyline Reserve nonetheless currently retains a highly significant vertebrate fauna. This fauna includes species assemblages which appear not to have been documented elsewhere, albeit in the context of Tasmania's poorly known vertebrate community ecology. While it does not appear to have retained all of its original inhabitants and does include some naturalised alien species, it is nonetheless a valuable resource.

The mammal fauna of Lambert Rivulet has intrinsic significance for the range of marsupial herbivores and omnivores, i.e. the bettong, potoroo and brown and barred bandicoots from single local area. Moreover, the bettong and the barred bandicoot are listed as mammals which "require monitoring" in Tasmania (VAC 1994). Neither of these species has adequate reserved habitat in southern Tasmania.

The bird and reptile faunas are rich in the Tasmanian context and although they don't have outstanding features they are valuable in their near-urban situation and for values which complement bigger and more durable reserves.

With fringing settlement on three sides and development continuing, pressure on the reserve is evident. Management of fire, of weed encroachment across reserve boundaries, and of exotic species, are important issues. Enhanced risk to its current integrity is envisaged if further isolation occurs or boundary pressures increase significantly.

## ACKNOWLEDGEMENTS

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share resources in the running of the project and provided unpublished records from its field survey activities.

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## BOOK REVIEW

### *The Reluctant Nation : Environment, law and politics in Australia*

*by Phillip Toyne*

Published by ABC Books. Price $16.95

Reviewed by Don Hird

Conservation battles, especially those involving potential for Commonwealth intervention, are the focus of this book. Three of the eight case studies relate directly to Tasmania. They are complemented by an introductory chapter, on the artificiality of State boundaries and the piecemeal rather than integrated national approach to conservation, and a concluding chapter, on the prospects for (or illusion of) a "new federalism" to help resolve this dilemma. Other chapters cover such issues as Fraser Island, Uluru, the Commonwealth's intervention (after much Queensland intransigence) over the World Heritage nomination of Daintree and surrounding wet tropics, and Coronation Hill. The common thread is the Commonwealth powers, through World Heritage, IUCN and Commonwealth Land Rights legislation, versus States' rights. The author's six years as Australian Conservation Foundation (ACF) Director until 1993, and his teaching of environmental law, are primary sources providing an immediacy in this often personal account.

Tasmanian examples rightly provide a major focus for this book. It is in Tasmania where federal action (or inaction) both won and lost major conservation battles. Thus, the federal (Whitlam) government elected not to test its incipient powers of intervention over the flooding of Lake Pedder in the early 1970's and it was the Franklin Dam which set the precedent for such Commonwealth actions. Further, the ACF, which until the flooding of Lake Pedder had refused even to speak out on that issue, was galvanised into a much less reticent organisation. Programs like National Estate and World Heritage thus become the central theme of this book, and indeed provide a heady mix of social, economic, cultural and natural values.

The public profile of conservation issues over this whole period has continually escalated, with organisations like ACF to the fore, and big public issues their forte. While this is acclaimed by some it is by no means the whole story. The risk is that in the quest for the "media 30 second grab", simple answers to complex conservation issues will be given as demanded and, as a result, be misleading or even incorrect. I feel that conservation has a deeper history, more of an intellectual base, and a greater diversity of players than acknowledged in this book. Focussing on media attention has all the attendant risks of populism, battle fatigue and potential for conflict of interest, especially when fundraising is a competing priority.

Tasmania hasn't yielded easy answers to these sorts of dilemmas. The problem can only be exacerbated when meaningful dialogue and an adequate knowledge base is lacking. One such example is the ongoing forestry debate (grudging admission of hydroelectricity oversupply has recently arrived). This standoff is manifested by ongoing boycotts by the "conservation movement" (as self-defined and purportedly monolithic) of State government consultative or policy committees and the retaliatory lack of adequate public consultation on many conservation issues. The strident government line is that too much land is "locked up" in reserves, even when our biodiversity is clearly not always well protected. The social impact of ACF's "no logging in native forest" policy on local communities deserves a more thorough acknowledgement. Local goodwill is often a critical ingredient in long-term conservation with legislation a small but important component of the process. Another relevant issue passed over is the quality of conservation methodologies and strategies developed and funded at a federal level in recent years.

As representative of the Tasmanian Field Naturalists on the Field Government's World Heritage Advisory Council (WHAC) in 1991, I was surprised at the opposition from the resource exploitation lobby to the nomination of Macquarie Island. However, after spirited discussion the nomination substantively succeeded. The conservation movement as colourfully depicted in this book loudly protested its forestry boycott (which extended to the WHAC), such that it was necessary to run their gauntlet to reach the venue. Macquarie Island should have been an uncontroversial nomination, and indeed could have been taken to be tokenism or a diversion, but surely that is the part of the real debate we sorely need and aren't currently having. I unsuccessfully searched for a reference to this success amongst Tasmania's litany of sins in this volume.

In conclusion, I found this book a stimulating read despite its top-down, often legalistic perspective. The author offers a convincing case that it is lack of political will rather than available power that now limits progress towards unified national environmental standards. Few conservation enthusiasts would disagree, but similarly few could deny that the pockets of entrenched resistance are as strident as ever. I missed deeper discussion on cooperative formulation of priorities and targets, and on a strategic rather than a crisis-management focus in resolving conservation issues. Rather than a Reluctant Nation it seems to me that we often remain an ambivalent Lucky Country. We still seem to want kilograms of Saturday's classified newsprint as well as our natural heritage, nice beaches, and not too many details of the best way to attain them !

## ADVICE TO CONTRIBUTORS

*The Tasmanian Naturalist* publishes articles on all aspects of natural history and the conservation, management and sustainable use of natural resources. These can be either in a formal or informal style. Articles need not be written in a traditional scientific format unless appropriate. A wide range of types of articles is accepted. Examples include observations of interesting or unusual animal behaviour, flora or fauna surveys, aspects of the biology and/or ecology of plants and animals, critical reviews of management plans and overviews on contemporary issues relating to natural history.

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### Submission of Manuscripts

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Ratkowsky, A.V. and Ratkowsky, D.A. (1976) The birds of the Mt. Wellington Range, Tasmania. *Emu* 77: 19-22.

Watts, D. (1993) *Tasmanian Mammals. A Field Guide.* (Peregrine Press, Kettering).

Ponder, W.F. (1993) Endemism in invertebrates in streams and rivers as demonstrated by hydrobiid snails. In *Tasmanian Wilderness: World Heritage Values*. Eds. S. Smith and M. Banks. (Royal Society of Tasmania, Hobart).

Bryant, S.L. (1991) The Ground Parrot *Pezoporous wallicus* in Tasmania: Distribution, Density and Conservation Status. Scientific Report 1/91. Department of Parks, Wildlife and Heritage, Hobart.

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# Tasmanian Field Naturalists Club Inc.

## G.P.O. Box 68A, Hobart, Tas. 7001

Founded 1904

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The Tasmanian Field Naturalists Club aims to encourage the study of all aspects of natural history and to advocate the conservation of our natural history. The club is comprised of both amateur and professionals who share a common interest in the natural world.

### ACTIVITIES

Members meet on the first Thursday of each month in the Biological Sciences Building at the University of Tasmania at Sandy Bay. These meetings include a guest speaker who provides an illustrated talk. This is followed by an excursion on the next Saturday to a suitable site to allow field observations of the subject of that week's talk. A mammal survey group also undertakes trapping and recording of native mammals in local areas. The Club's committee coordinates input from members of the club into natural area management plans and other issues of interest to members.

### *THE TASMANIAN NATURALIST*

The Club publishes the journal, *The Tasmanian Naturalist*. This journal provides a forum for the presentation of observations on natural history and views on the management of natural values in both formal and informal styles.

### MEMBERSHIP

Membership of the Tasmanian Field Naturalists Club is open to any person interested in natural history. *The Tasmanian Naturalist* is distributed free to all members, the club's library is available for use and a quarterly bulletin is issued with information covering forthcoming activities. Enquiries regarding membership should be sent to The Secretary at the above address or by phoning Don Hird on (002) 284 434.

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