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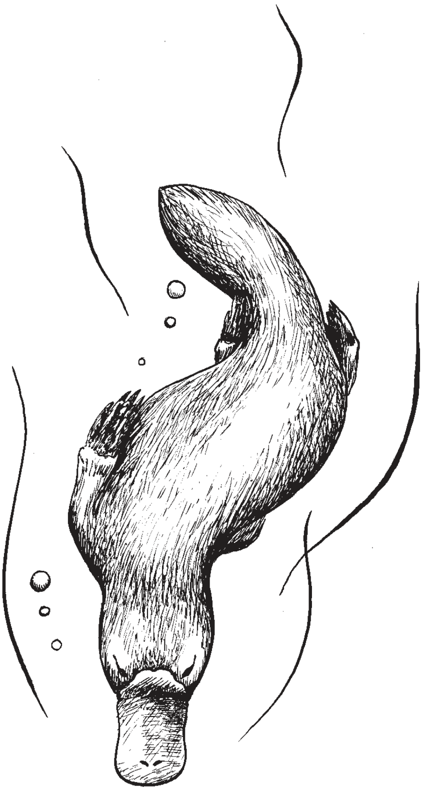

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A megadiverse beetle fauna showing an inordinate fondness for Tasmanian forests

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We have probably all heard of J.B.S. Haldane's quip that '*the Creator, if He exists, must have an inordinate fondness for beetles*'. A range of variant utterances on this same theme by Haldane, a pioneering evolutionary biologist, speak to his sense of wonder at the sheer diversity of beetle life on Earth. Haldane was well aware that beetle species outnumber, for instance, bird species by upwards of two orders of magnitude.

We now know that you don't have to go far to witness the megadiversity that so captivated Haldane. All the evidence that you need has been garnered over the past two decades through research in and around the Warra Long-Term Ecological Research (LTER) site, situated in Tasmania's Southern Forests immediately west of the Tahune Airwalk. The LTER site encompasses some 15,000 ha of forest and extends from the banks of the Huon River to the summits of Mounts Frederick and Weld (Brown *et al.*, 2001). Since its inception in 1995, Warra has hosted at least 200 research projects. Many of these have involved beetles, either as study-tools for exploring ecological processes and forest management impacts, or as objects of study in their own right. Most of this research has focussed on lowland wet eucalypt forest along Manuka Road, but forests at a range of altitudes up to the 1300 m summit of Mount Weld have also been sampled.

So, two decades on, just how inordinately fond of Warra are those beetles? Fortunately, we have maintained a database that can tell us. Across 27 research or monitoring projects that have involved sampling beetles, 490,469 beetle specimens have been collected, belonging to some 1,722 species! This is beetlemania writ large.

Before we go any further, it's worth remembering that, while lumping across projects like this enables us to explore some big patterns in the data, it also places limits on how we can interpret those patterns, because by default all data are treated equally regardless of the sampling biases of individual contributing projects. Some projects were short-term, over a single season; others long-term, over many seasons or years. All were selective in what they sampled: either because of the particular sampling techniques employed and the susceptibility of different beetle species to being caught by these different techniques; or because of the particular habitat sampled; or because of sampling location and extent. Sometimes these biases may be masked in the final data, while at other times they may come to the fore. Most records emanate from just two long-term projects, the silvicultural systems trial and the log-decay project, and from one intensive but short-term study, the FWPA landscape biodiversity project. As part of the silvicultural systems trial, beetles have been sampled through monthly pitfall-trapping across a range of sites along Manuka Road, before and after various experimental forms of forest harvesting and regeneration, as well as in a nearby unharvested mature-forest control site. While pitfall traps catch a range of beetles, only three beetle families – Carabidae (ground-beetles), Leiodidae (fungus-beetles) and Curculionidae (weevils) were selected for sorting and databasing. Meanwhile the log-decay project has sampled monthly the beetles of all families emerging from twelve eucalypt logs over the course of their first decade after felling. The landscape biodiversity project sampled, over the space of a few months, beetles of all families by means of flight intercept traps operating at 59 locations spread from Warra and Picton in the west through the 'Southern Forests Experimental Forest Landscape' towards Geeveston in the east.

So, what do the aggregated data tell us? First, it seems that not all beetle species are created equal. The Creator, if She exists, shows alarming favouritism – at least if frequency of capture is accepted as a proxy for relative abundance or rarity. Of those 1,722 species, nearly a third (531 species) were only collected on a single occasion, and fully one-fifth (350 species) were singletons, i.e. only recorded on the basis of a single beetle (Figure 1). Meanwhile just one-fifth of the species contribute 93% of all the records (Figure 2). Why the apparent fondness for the top-ranked ground-beetle *Notonomus politulus* (which grabbed fully 5% of all records for itself) may not be for us mere mortals to ponder. It's clearly a very successful, predatory ground-active beetle – or at least very susceptible to falling into pitfall traps set on the forest floor.

Fgure 3 illustrates a common property of species frequency distributions, one that can be termed the 'commonness of rarity'. In other words, most of the species are represented by a very few individuals, which form a very long 'tail' to the distribution. Some early researchers (Preston 1948) argued that more intensive or comprehensive sampling would shift this distribution to the right and gradually a bell-shaped or normal distribution would emerge, with the rare species eventually making up a smaller proportion of the overall collection: those species originally represented by singletons would have their numbers increased as the collection

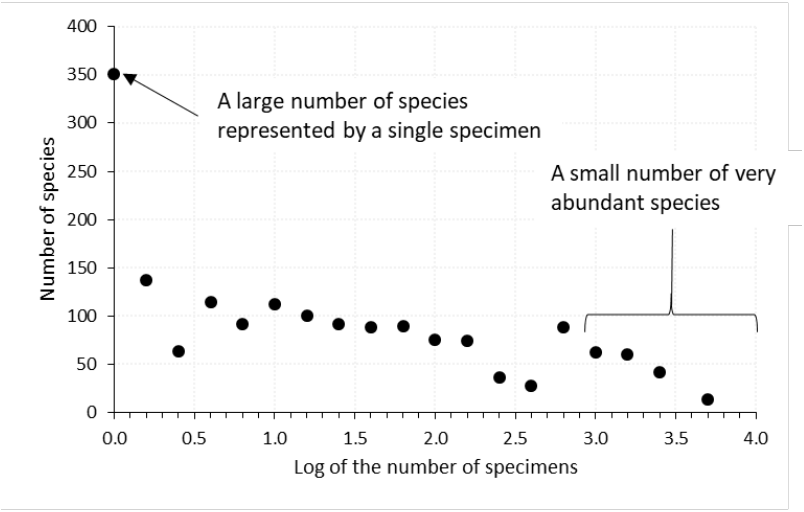

Figure 1. Number of beetle species by abundance classes. Classes are based on the logarithm (base 10) of the number of specimens in the Warra data-set.

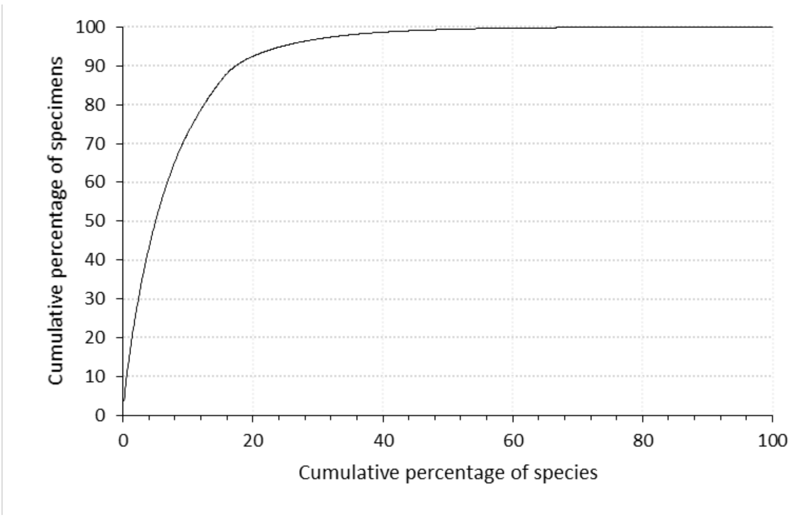

Figure 2. Quantile plot showing the cumulative percentage of beetle species versus the cumulative percentage of beetle individuals in the Warra data-set.

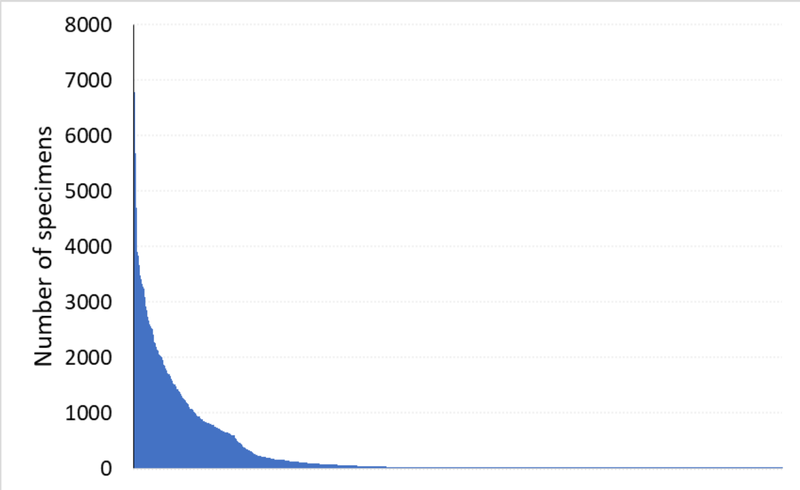

Figure 3. The number of specimens of each of the 1722 beetle species in the Warra data-set, ranked left to right from the most to the least abundant species.

got larger, and eventually fewer new species would enter the collection to take their place. It's true that the more you sample, the more your singletons become doubletons or multiples. However, for insect sampling at least, the data-set tends to accumulate an even larger number of newly recorded singleton species in place of those that have become doubletons or multiples (Straatsma & Egli, 2012), perpetuating the overall species frequency distribution.

In conservation biology, rare species are usually the ones that we focus on, in the belief that rarity equates to vulnerability. Think orange-bellied parrots and forty-spotted pardalotes. But here's the rub: for rare beetles and other invertebrates, it becomes inordinately difficult to test either their vulnerability or their ecological importance when they're so, well, rare. Such species are absent from nearly all of the samples collected, so there is simply not enough information for standard statistical techniques to work properly. And there are many reasons why such species are absent from most of the samples, ranging from the sampling biases and detection issues that we have described already through to serendipitous dispersal of individuals from other habitats. Notwithstanding their appeal with the general public and lawmakers, truly rare species such as these are simply too hard to deal with quantitatively.

Only about a third of all the putative beetle species in the data-set have formal scientific names. The other two-thirds are the 'known unknowns': we can separate one from another, and we can often say what genus or subfamily each belongs to, but we cannot pinpoint a specific name. The issue is particularly acute for the rare species in our data-set, applying to three out of every four of our singleton species, whereas about half of the most common species are assignable to described species (Figure 4). If Warra were situated in northern Europe, this situation would be cause for dire embarrassment at our apparent incompetence, since nearly every beetle species that has ever been found in that region has been formally described, and keys and other means of identification are readily available. However, this is far from so in our little corner of the world. In some cases, our inability to assign a specific name may be because the only specimens – or specimen – available to us are in poor condition and are missing the key characters necessary for identification. In other cases, it may be that we do not have access to comparative material, or to the scientific papers in which the original descriptions of a particular set of species were documented – and even if we can access the original descriptions, many of the older ones are not enlightening because they lack sufficient morphological detail. Others of our unnamed species may have been put in the too-hard basket for the time being. But in the vast majority of cases, the lack of a name is likely to reflect the fact that nobody has yet formally described the species concerned: they are 'new to science'. Clearly, despite some welcome recent

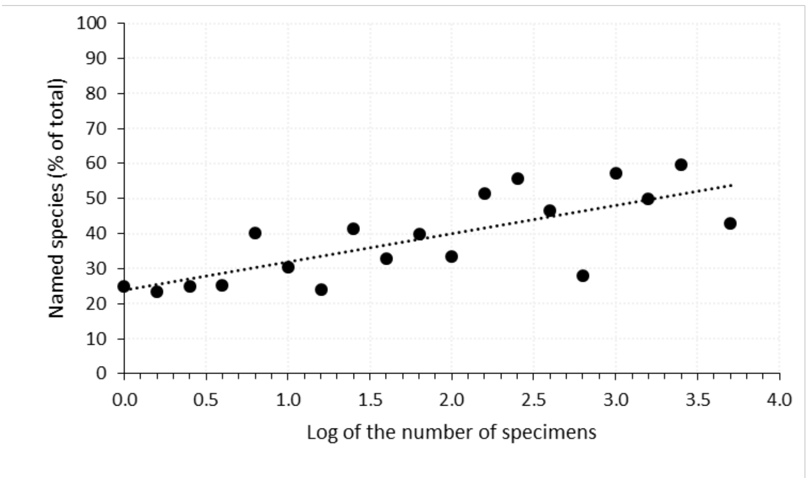

Figure 4. Named species as a proportion of all species, ranked by species abundance class. Classes are based on the logarithm (base 10) of the number of specimens in the Warra data-set.

Figure 5. A selection of moss-beetles (Byrrhidae) from Warra that have been given new identities following recent taxonomic revision (Lawrence *et al.,* 2013). Top left: *Nothochaetes fasciculatus* 2.0 mm; top centre: *Notolioon griffithi* 3.5 mm; top right: *Noltolioon multicolor* 1.6 mm; middle right: *Notolioon simplicicornis* 3.1 mm; bottom left: *Notolioon nodipennis* 5.6 mm; bottom right: *Pseudomorychus mixtus* 2.1 mm. Photographs: Lynne Forster.

advances in beetle species description that have made use of Warra-collected specimens (e.g. Lawrence, 2016; Lawrence *et al*., 2013 – see Figure 5; Turco *et al*., 2013) there is still a lot of taxonomic work to do on Tasmanian beetles – and hardly anybody able to do so. The 'taxonomic impediment' (Agnarsson & Kuntner, 2007) is alive and well in Tasmanian entomology.

Beetles at Warra, it seems, have an inordinate fondness for logs and old trees (Figure 6). Almost two-thirds of all beetle species in the data-set have been recorded in association with logs and/or 'mature timber habitat' on living trees – a quarter of all species exclusively so. We call these species 'saproxylic' (Speight, 1989). It is not clear whether these figures reflect the real proportion of saproxylic species at Warra, given the sampling biases in favour of these habitats in a number of research projects (as discussed in Grove, 2009). Nevertheless they compare with 56% saproxylicity for forest beetles in Central

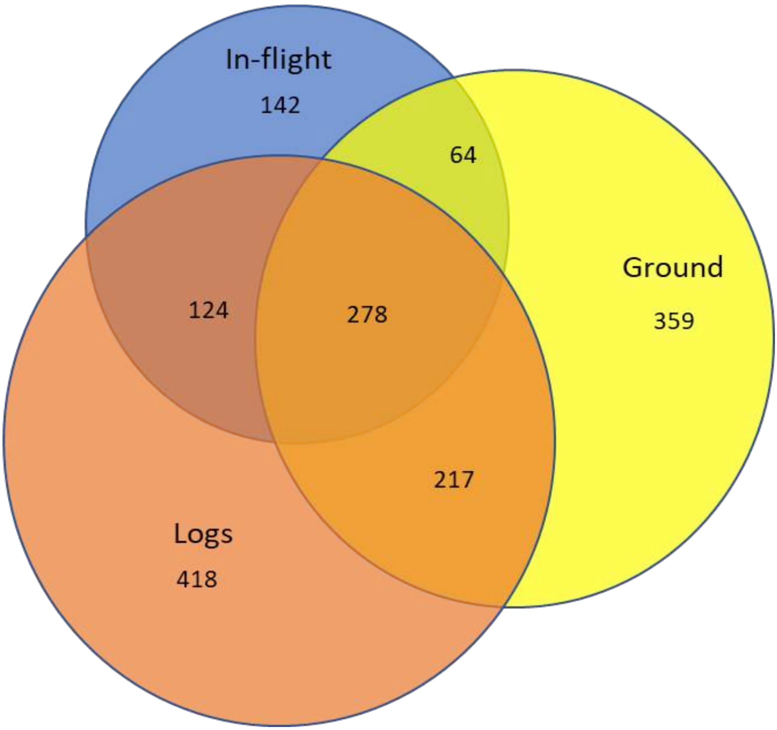

Figure 6. Venn diagram showing the number of beetle species in the Warra data-set captured from logs, from the ground and in-flight.

Europe (Köhler 2000), and 34% for beetles in Finnish boreal forest and 33% for beetles in lowland tropical forests of Sulawesi (Hanski and Hammond, 1995). It is perhaps surprising that rather fewer species in the data-set are associated with ground-level sampling (i.e. pitfall trapping), until it is remembered that this proportion of the data is almost entirely linked to pitfall trapping in the silvicultural systems trial, which has focused on just three beetle families.

The third category in Figure 6, for beetles caught in flight, suggests (through its relatively minor representation) that most beetle species sampled at Warra are either flightless, or choose not to fly most of the time. Flightlessness is a trait that often evolves in species that have no great need to disperse over long distances – a situation that applies particularly to species living in stable environments (Roff, 1990). On the face of it, the preponderance of such species at Warra doesn't sit comfortably with the natural disturbance dynamics of wet eucalypt forests, in which periodic wildfires more or less reset succession every few decades or centuries (Jackson, 1968). However, some of our research has suggested that large logs and dead standing trees can remain remarkably intact even in the face of intense fire, providing an unexpected continuity in habitat for saproxylic species. In any case, the dominant tree species at Warra, *Eucalyptus obliqua*, can survive all but the most intense fires and will re-sprout from epicormic buds. Scarred but not killed, their value for saproxylic species is thereby enhanced as they weather successive fires (Wardlaw *et al*., 2009). Furthermore, fire-skips (parts of the landscape that escape the full impact of any single wildfire) are also likely to be common enough in Tasmania's rugged terrain to act as 'lifeboats' for beetles that would otherwise be locally wiped out. Research in and around Warra shows that such beetles are capable of walking their way back into the nearby regenerating forest, recolonising as the habitat becomes suitable once again (Fountain-Jones *et al*., 2015).

One more emergent pattern in the data is worth some comment: seasonality. It goes almost without saying that in temperate latitudes summer is the time for entomologists to go looking for insects and winter the time to hibernate (or to write up your research). But that's not the full story. Figures 7 and 8, based on the two multi-year projects at Warra in which samples have been collected monthly, show that winter is far from dead. Granted, the number of species and individuals active enough in winter to end up in traps is only about a quarter to a fifth of the number in high summer; but it's not zero. Some of the winter-active beetles are members of the same species that are also active in summer, including some of the most abundant species (Figure 8); but others are uniquely winter-active. The Warra winter may be chilly, but it's clearly not so cold that some beetles can't take advantage of what little warmth there is to make a living for themselves while others are dormant. Interestingly, winter beetle activity is mirrored in the continued intermittent photosynthetic

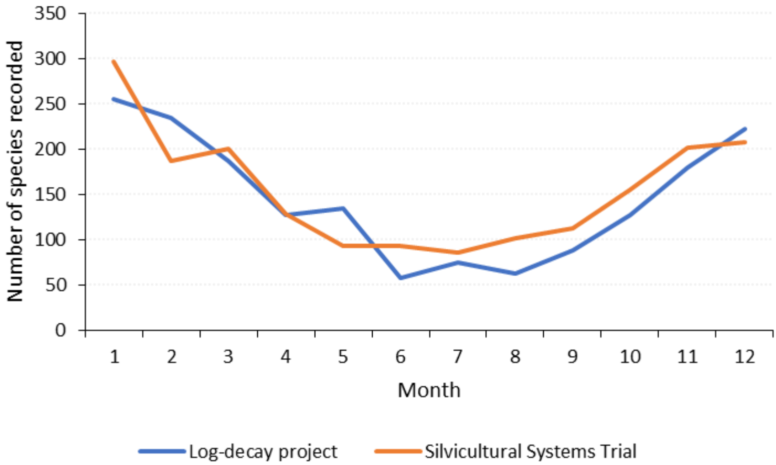

Figure 7. Monthly number of beetle species (January on left to December on right) recorded from two multi-year studies at Warra.

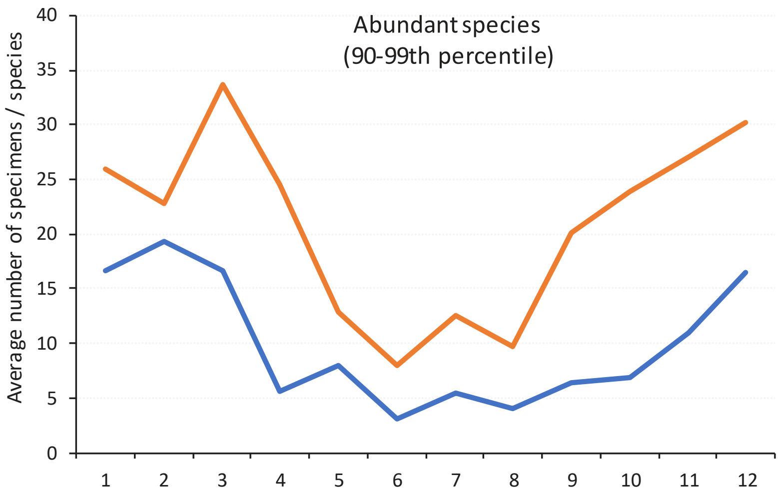

Figure 8. Mean monthly number of specimens per species (January on left to December on right) for the most numerous beetle species (those in the 90th to 99th percentile for abundance), recorded from two multi-year studies at Warra.

activity of the overhead eucalypts, according to as-yet unpublished analyses of carbon dioxide levels at Warra's cutting-edge flux tower. Contrast this pattern with temperate latitudes in the Northern Hemisphere, where for the most part nothing moves or grows in winter. We may have the Roaring Forties to thank for an ameliorating influence on our climate.

All this science, all this analysis – and critically, all these beetles – just from one small and relatively homogeneous patch of Tasmania. Now imagine how many beetle species might be present across the whole of Tasmania! We can't give you an accurate figure because the calculation involves too many unknown unknowns. But to put in context any figure that your imagination might come up with, Wikipedia (to take a readily available online resource) lists just 262 bird species for the island of Tasmania and surrounding seas. Beetles really are a very speciose lot.

The beetles that contributed their lives to research at Warra continue to give long after their death: the data are available for future generations of ecologists, while the specimens now mostly reside in the state collections at the Tasmanian Museum and Art Gallery, awaiting the day when beetle taxonomists or others with an interest in their morphology or DNA come a-knocking. They shall not be forgotten.

Acknowledgement

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Predation on fairy penguin chick *Eudyptula minor* (Aves: Spheniscidae) by the Tiger Snake *Notechis scutatus* (Serpentes: Elapidae) in Southeast Tasmania

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Introduction

Recent years have seen the rapid and almost ubiquitous take up of mobile communication devices (mobile phones) by the public, many of which now allow people to take high resolution photos wherever they happen. In addition, relatively cheap digital cameras allow more people than ever before to capture field images of wildlife. In conjunction with this phenomenon is the appearance of increasing numbers of wildlife predator/prey interactions appearing in social media. Snakes generate a great deal of public interest and there has been an explosion in the last decade of sometimes fascinating photos of wild snakes engaged in all manner of behaviours. Many of these photos are of snakes discovered devouring prey, and in some cases they represent the only documentation of poorly known trophic interactions. Snakes are difficult creatures to study in the wild due to their generally cryptic habits and so some of these photographed behaviours may be of great interest to professional herpetologists. Often the people taking such photos are unaware of the significance of their observations and so valuable supporting data can be lost. Several previous papers on Tasmanian snake trophic ecology have resulted from photographs arising from chance encounters in the field and made available to the second author (Oliver *et. al.* 2010, Fearn and Tierney, 2014). This brief paper outlines another example where a chance encounter documents a previously unrecorded prey item for the tiger snake *Notechis scutatus*.

Tiger snake trophic ecology

The trophic ecology of the tiger snakes of the Tasmanian region is summarised by Fearn *et. al.* 2012 and Fearn, 2014. *Notechis scutatus* can be described as a generalist carnivore, predating on a wide range of suitably sized mammals, birds, reptiles, amphibians and fish. Hatchlings and nestlings of a wide range of birds are incorporated in the diet. These birds are predominately ground or near ground nesting species but tiger snakes have been recorded high in large trees or in the roofing of human dwellings raiding nests. Seabird chicks often hatch close together in space and time to increase their chances of survival by saturating the capacity of their predators on many offshore islands- the most well-known being the mutton bird or short tailed shearwater *Puffinus tenuirostris* (Schwaner, 1985, Schwaner & Sarre, 1988).

The fairy or little penguin *Eudyptula minor* is common and widespread around the southern Australian coastline where much of its range overlaps broadly with that of *N. scutatus* (Simpson and Day, 2004, Wilson & Swan, 2013). Nesting typically takes place in vegetated dunes and rocky habitats beyond the high tide mark (Simpson & Day, 2004). It has long been suspected that adult tiger snakes would be capable of ingesting *E. minor* hatchlings but the behaviour has never been documented. In February 2017 a colleague alerted the second author to a series of photographs that appeared on Facebook depicting a large tiger snake ingesting a fairy penguin chick on Maria Island, south east Tasmania. The second author was subsequently able to make contact with the photographer (senior author) who readily agreed to publish the photographs as well as documenting the observed predator prey interaction.

Field Observations

On the 21st of November 2008 at 1625hrs, the senior author observed a large tiger snake, approximately 1.5m in total length, in the act of swallowing an approximately 200mm *E. minor* chick between the historic cement silos and clinker storage building beside the Fossil Cliffs circuit walk, north east Maria Island (Plate 1). The chick was estimated at 4-5 weeks of age with a mass of 800-1000g (A. Chiaradia and P. Dann pers. comm.) The snake was completely exposed on short cropped lawn and appeared unconcerned by a group of tourists who had gathered to watch it. When first observed the snake had ingested the majority of the chick's body but was struggling with the bulbous posterior of the chick (Plate 2). The snake was observed and photographed for approximately 30 minutes as it attempted to ingest the chick, which was clearly at the upper limit of its ingestion capability. The senior author had to leave the scene before the snake had completely ingested its prey.

Plate 1. Location in north east Maria Island where the predation observations took place.

The following day the snake was observed in the same place basking full length with a large ingested prey bolus that conformed to the penguin chick (Plate 3).

Notechis scutatus is common on Maria Island and large mature specimens with home ranges that overlap with *E. minor* rookeries would be expected to take advantage of such seasonally reliable prey items. The rapid development of sea bird chicks limits predation by snakes in southern Australia because the chicks quickly attain sizes beyond the ingestion capabilities of even the largest snakes (Schwaner, 1985). The only other large snake on Maria Island is the lowlands

Plate 2. Large adult *Notechis scutatus* on Maria Island swallowing 4-5 week old *Eudyptula minor* chick. Photograph: Brad Hall.

Plate 3. The same snake the following day basking with a large ingested prey bolus. Photograph: Brad Hall

copperhead *Austrelaps superbus* but this specialist amphibian feeder does not have the head size or gape to enable it to ingest *E. minor* chicks (Fearn *et. al.* 2012).

The authors encourage anyone who takes photos of wildlife predator-prey interactions to make the images available to experts in that particular field so that such observations and images can be placed in a scientific context and hopefully published.

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Changes to threatened species lists in Tasmania since 1995

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Background

Tasmania's *Threatened Species Protection Act 1995* (TSP Act) commenced in 1995 with Schedules of extinct, endangered, vulnerable and rare species at risk based largely on lists compiled by advisory committees comprising native vertebrate, invertebrate and higher plant experts in Tasmania (Invertebrate Advisory Committee 1994, Flora Advisory Committee 1994, Vertebrate Advisory Committee 1994).

One of the roles of the Scientific Advisory Committee (SAC) established under the TSP Act is to advise the Minister on the listing and delisting of taxa of flora and fauna from the Schedules. Nominations for the SAC to consider recommending changes to the conservation status of species to the Minister can be made by any member of the public. The SAC must consider any public comments following notification of a preliminary nomination before making a final recommendation to the Minister. The SAC may also directly recommend to the Minister any variation of the threatened species Schedules considered appropriate and indeed is obliged to review the status of each listed taxon at least once in each period of 5 years. These mechanisms allow the threatened species schedules to be updated with changes to the understanding of the range and abundance of species and their threats. It also allows for taxonomic updates and changes to the eligibility of taxa for listing (e.g. if a taxon has been deemed not to be native to Tasmania).

The SAC is responsible for determining the criteria for the listing of species and to prepare guidelines as to how the criteria are to be applied. The current criteria (Scientific Advisory Committee 2008) are largely based on 1994 IUCN Red List Categories and Criteria version 2.3 criteria (IUCN 1994).

Changes and their drivers

The overall number of species listed under the TSP Act has increased by 9.5% in the 21 years since inception (to 2016). The increase is largely due to an increase in the number of listed vertebrates (birds, fish and mammals) and the addition of non-vascular flora (28 of the 30 being lichens) to the threatened species Schedules (Table 1).

Table 1. Number of species listed on the TSP Act at inception (1995) and in August 2016 per taxonomic group and extinction risk category, x=presumed extinct (Schedule 3.2), e=endangered (Schedule 3.1), v=vulnerable (Schedule 4), r=rare and at risk (Schedule 5)

FLORA				**FAUNA**		**1995**	**2016**
	x	29	20		x	12	8
	e	35	144		e	19	67
	v	59	75		v	37	45
	r	342	249		r	86	70
	total	**465**	**488**		**total**	**154**	**190**
FLORA vascular				**FAUNA vertebrate**			
	x	29	19		x	5	5
	e	35	135		e	12	34
	v	59	71		v	19	24
	r	342	233		r	8	8
	total	**465**	**458**		**total**	**44**	**71**
Dicotyledonae	x	22	14	Amphibians	x	0	0
	e	29	64		e	0	1
	v	47	53		v	1	1
	r	186	147		r	0	0
	total	*284*	*278*		*total*	*1*	*2*
Monocotyledonae	x	6	4	Birds	x	4	4
	e	5	62		e	5	18
	v	5	12		v	11	11
	r	144	78		r	5	3
	total	*160*	*156*		*total*	*25*	*36*
Gymnospermae	x	0	0	Fish	x	0	0
	e	0	0		e	3	6
	v	1	2		v	2	7
	r	1	0		r	1	2
	total	*2*	*2*		*total*	*6*	*15*
Pteridophyta	x	1	1	Mammals	x	1	1
	e	1	9		e	3	7
	v	6	4		v	1	1
	r	11	8		r	2	2
	total	*19*	*22*		*total*	*7*	*11*
FLORA non-vascular				Reptiles	x	0	0
	x	0	1		e	1	2
	e	0	9		v	4	4
	v	0	4		r	0	1
	r	0	16		*total*	*5*	*7*
	total	0	30				
				FAUNA invertebrate			
ALL SPECIES		**1995**	**2016**		x	7	3
	x	41	28		e	7	33
	e	54	211		v	18	21
	v	96	120		r	78	62
	r	428	319		**total**	**110**	**119**
	total	**619**	**678**				

The pattern of changes within each risk category is similar for flora and fauna species, with large increases in the number of species in the endangered category and decreases in the number of species listed as rare and at risk, and smaller increases in the number of vulnerable species and decreases in the number of extinct species (Table 1). Most of the new additions to the fauna schedules were made in 2002 while most of the changes between the schedules for fauna species were made in 2008 following a comprehensive review of the status of listed fauna species. Only 10 fauna taxa (all but one being invertebrates) have been delisted as opposed to 98 for flora (Figure 1).

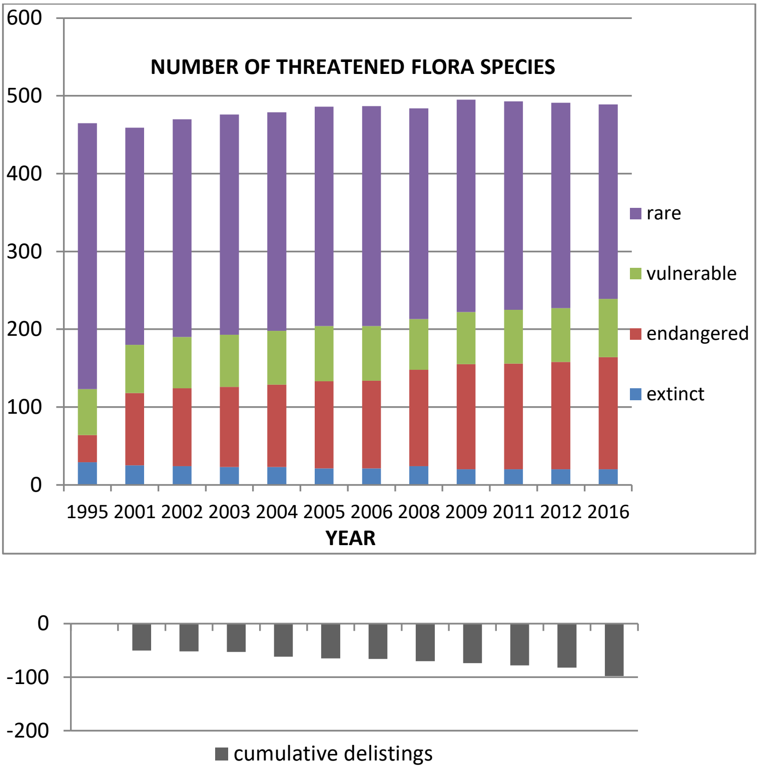

Figure 1. Graph of the number of flora species listed on the TSP Act at inception (1995) and in the following years during which changes were made and the cumulative number of delistings in the same years shown below

Changes in the number of listed flora species in each of the risk categories have been spread more evenly over the years and are detailed in Figure 1. The first adjustments to the schedules (gazetted in 2001) were the greatest and can be attributed to several major factors including:

- the formulation of listing criteria and guidelines;
- an increased focus on compiling distribution, abundance and threat data for threatened species (leading to the creation of the Natural Values Atlas which went online in 2006);
- a comprehensive review of the conservation status of 195 Tasmanian native orchids precipitated by the book *The Orchids of Tasmania* (Jones *et al*. 1999) the production of which followed a major review of both the distributions of orchids (Ziegeler *et al*. 1995) and the taxonomic status of Tasmanian Orchidaceae (papers by Jones and others e.g. Jones 1998);
- the compilation of background reports produced in 1996 and 1997 to inform the *Tasmanian Regional Forest Agreement 1997*;
- the preparation of Notesheets or Listing Statements for all Tasmanian listed flora species published as the *Threatened Flora of Tasmania* CD (Threatened Species Unit 2003).

Since 2001, changes to the threatened flora schedules have been in large part due to the following factors:

- an increase in the distribution, abundance and threat data as a result of data provision conditions of permits issued to take threatened flora for identification purposes (as in the *Guidelines for Terrestrial Natural Values Surveys related to Development Proposals*) or scientific purposes;
- the preparation and implementation of Recovery Plans, particularly for multispecies Recovery Plans;
- the preparation of Listing Statements with major inputs resulting from recommendations to increase the proportion of listed species with Listing Statements following the *Tasmanian Regional Forest Agreement 1997* and the 2009 Auditor-General's Special Report into the management of threatened species in Tasmania;
- the preparation of Species Profiles for the Australian Government Species Profile and Threats Database in order to align State and National threatened species lists;
- public nominations for the listing of lichen species in particular (there are few public nominations for listing flora species in Tasmania);
- revisions of the Tasmanian vascular plant census, now published annually by the Tasmanian Herbarium (with new species, taxonomic splits, mergers and native status changes triggering changes to the threatened species schedules);
- field work by staff of the Department of Primary Industries, Parks, Water and Environment, Forest

Practices Authority and University of Tasmania and volunteers of Wildcare's Threatened Plants Tasmania group;

• increased knowledge of the ecology and recruitment strategies of plants from seed collection and germination data from activities conducted through the Tasmanian Seed Conservation Centre.

2016 changes to the listed flora schedules on the TSP Act

Changes in 2016 resulting from nominations/recommendations processed since September 2012 included:

• consideration for listing of nationally listed taxa under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on schedules of the Tasmanian TSP Act. This has resulted in the listing of *Argyrotegium nitidulum* and *Xerochrysum palustre* as vulnerable (further alignment of the State and National threatened flora lists have occurred with the delisting of *Carex tasmanica* from the EPBC Act in 2016);

• listing of taxa following assessment including *Ranunculus diminutus, Pimelea* sp. *Tunbridge* and *Thelymitra improcera*, and those taxa that have only relatively recently been recognized as occurring in Tasmania and for which it is considered that sufficient data is available for a meaningful assessment of extinction risk including *Euphrasia amplidens*, *Senecio campylocarpus* and *Blechnum neohollandicum* (was *Doodia aspera*);

• delisting of taxa whose specimens are now recognized as belonging to taxa that do not meet the criteria for listing under the TSP Act including *Agrostis* aff. *hiemalis* and *Plantago gaudichaudii* (now considered to belong to *Agrostis propinqua* and *Plantago varia* respectively);

• consideration for listing of component taxa of already listed species as a result of taxonomic splits (and consequent delisting of the parent taxa) resulting in the delisting of *Hypoxis vaginata* (as neither of the two varieties were considered eligible for listing in their own right), the listing of the two components of *Pomaderris phylicifolia* (*Pomaderris phylicifolia* subsp. *ericoides* and *Pomaderris phylicifolia* subsp. *phylicifolia*) and the two components of *Vittadinia muelleri* (*Vittadinia muelleri* in the narrow sense and *Vittadinia burbidgeae)* as rare as per the parent taxa, the listing of *Pterostylis falcata* in the narrow sense and *Pterostylis lustra* as endangered (the parent *Pterostylis falcata* in the broad sense was previously listed as rare), and the listing of only one component of *Stellaria multiflora* (*Stellaria multiflora* subsp. *nebulosa*) as rare as per the parent species (as *Stellaria multiflora* subsp. *multiflora* was not considered to meet the criteria for listing);

• delisting of a taxon deemed to be introduced to Tasmania (*Rytidosperma popinensis* used to be considered to be endemic to Tasmania but is now considered to belong to *Rytidosperma* *fulvum* which is widespread on mainland Australia and deemed not to be native to Tasmania);

- delisting of species for which the known distribution and abundance had increased to the point of their being considered widespread and not at risk including *Arthropodium strictum, Austrostipa nodosa, Cynoglossum australe, Deyeuxia densa, Lepidium pseudotasmanicum, Ranunculus sessiliflorus* subsp. *sessiliflorus* and *Senecio velleioides;*

- delisting of coastal species that were not considered to be at risk and where their distribution was not considered to be restricted including *Lachnagrostis scabra* subsp. *scabra*, (now *Lachnagrostis rudis)*, *Poa poiformis* var. *ramifer* and *Sporobolus virginicus*;

- uplisting of species as a result of status reassessment associated with the preparation of a Listing Statement including *Millotia muelleri* uplisted (from rare to endangered), and *Rumex bidens* and *Pterostylis squamata* (both uplisted from rare to vulnerable);

- downlisting of species as a result of status reassessment associated with revision of a Listing Statement following extension surveys, including *Prasophyllum amoenum* and *Prasophyllum apoxychilum* (both downlisted from endangered to vulnerable);

- name changes where *Bossiaea obcordata* is now *Bossiaea tasmanica* (and now considered to be endemic to Tasmania), *Leucopogon lancelatus* var. *lanceolatus* is now *Leucopogon affinis,* and *Doodia caudata* was changed to *Blechnum rupestre* (though will be changed in due course to *Blechnum spinulosum* as per the latest census).

2016 changes to the listed fauna schedules on the TSP Act

These resulted from nominations/ recommendations processed since September 2012) including:

- uplisting of *Migas plomleyi* from rare to endangered as a result of status reassessment associated with the preparation of a Listing Statement and a change of the common name to Plomleys Trapdoor Spider;

- *Austrochloritis victoriae* (Southern Hairy Red Snail) is now *Chlorobastistes victoriae*, and the common names of 27 freshwater snails have changed.

Other changes

- the EPBC Act has listed two species of handfish, *Thymichthys politus* (Red Handfish) and *Brachiopsilius ziebelli* (Ziebells Handfish). These species have also been listed as endangered on the TSP Act as a result of public nominations;

- assessment of the Tasmanian conservation status of newly listed EPBC Act species that occur in Tasmania;

- changes to scientific and common names will be addressed including taxonomic changes to listed species in the Tasmanian Herbarium's annual census of Tasmanian vascular plants;

• reassess the status of species when new information pertinent to their conservation status becomes available;

• assessment of vascular plant species tagged in NVA as 'possibly threatened' focusing on species that are highly representative of their family or genus in Tasmania, especially if they are Tasmanian endemics or have a limited distribution on mainland Australia (there are 127 vascular plant species at the time of writing that are tagged as 'possibly threatened' in NVA);

• reassessment of the status of vascular species in certain groups that have a large proportion of listed species e.g. orchids, *Vittadinia* species, *Senecio* species;

• together with other State and Territories, a Memorandum Of Understanding has been signed with the Australian Government to adopt a Common Assessment Method (CAM) based on current IUCN criteria and categories to assess the status of species, necessitating changes to the TSP Act to accommodate the change in risk categories.

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The elusive Weldborough forest weevil, *Enchymus* sp. nov. Zimmerman 1991 (Coleoptera: Curculionidae)

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The Weldborough Forest Weevil, *Enchymus* sp. nov. is a medium sized canopy- dwelling beetle, 10-12 mm in length and dull grey-brown in colour (Plate 1). Its main distinguishing features are the two prominent paired projections towards the apex of the elytra. Many other Tasmanian weevil species are similar in colour and size and also possess elytral projections; however, all are only superficially similar to *Enchymus* sp. nov..

Enchymus sp. nov. is listed as rare on the schedules of the Tasmanian *Threatened Species Protection Act 1995*. The species was first recorded from pitfall trap samples collected in February 1980 in rainforest 4.4 km southeast of Weldborough in NE Tasmania (Zimmerman 1991; Coy *et. al.* 1993).

Plate 1. *Enchymus* sp. nov. on *Nothofagus cunninghamii* twig.

The type specimens bear the collectors names A. Newton and M. Thayer. Upon closer investigation, it appears that at the time of listing, the Weldborough Forest Weevil was not officially assigned to the genus *Enchymus*, rather, it was allocated to "nr *Enchymus* sp. nov." (Zimmerman 1991), although on the Tasmanian legislation it remains *Enchymus* sp. nov. and will be so for this article. In 2005 the Forest Practices Board zoology section conducted a study into the presence of *Enchymus* sp. nov. in mixed forest - rainforest on private property near Weldborough, approximately 3 km southwest of the Weldborough Pass (Richards and Spencer 2005). Pitfall traps along four transect lines covering a wide range of habitat types were deployed. This method was selected due to the belief that the animal was ground dwelling, as the previous specimens had been trapped in this way. Additional sampling for weevils by hand searching of habitat types (such as beneath bark and logs and within leaf litter piles) was also conducted. While four weevil species were recorded during this survey, none was identified as the Weldborough Forest Weevil.

It was not until 2014 that the existence of further specimens was revealed to the wider Tasmanian scientific community. A specimen was captured by Jane Keble-Williams in November 1999, taken by foliage beating of *Nothofagus cunninghamii* (Keble-Williams 2012). On a visit to the Australian National Insect Collection (ANIC), Canberra, to confirm the identity of Jane's weevil, Simon Grove (TMAG) discovered that a further

Plate 2. *Enchymus* sp. nov. habitat, Mt Michael Track, Blue Tier

five specimens had been collected by pyrethrum knockdown in rainforest at Mount Michael (Blue Tier) by R. Coy and H. Mitchell in November 1989 (Coy *et. al.* 1993).

In March 2015 the authors, accompanied by Clare Hawkins and Keith Martin-Smith, surveyed for the species at Poimena, Weldborough Pass and Lottah Road using the foliage beating technique detailed in Keble-Williams (2012). Surveys focussed on the rainforest species *N. cunninghamii*, *Acacia dealbata*, *A. melanoxylon* and *Athosperma moschatum*. Several weevils were collected, but no *Enchymus* sp. nov. were recorded. After reviewing our approach, in 2016 the authors set out in November, targeting Sun Flats Road and Mount Michael Track at Poimena (Plate 2), in the vicinity of known locations for the species. We concentrated on foliage beating of *N. cunninghamii*, this time using a large collecting ground-sheet. Specimens of Elateridae, Blattidae and Carabidae were collected, as well as numerous weevil species, including ten *Enchymus* sp. nov.. A second expedition was undertaken in February 2017 employing the same survey technique, targeting areas at the Murdochs Road end of Sunflats Road, New England Road, Lottah Road and Weldborough Pass. Additionally, we revisited the previous positive sites at Mount Michael Track as well as ascending to the summit of Mount Michael and sampling several sites along the track. All sites were negative for *Enchymus* sp. nov. or other weevil species.

Excluding the original pitfall trapped specimens, all *Enchymus* sp. nov. to date have been collected in November; our negative survey results in March 2015 and February 2017 add weight to our hypothesis that the adults may only be active for a short period in late spring/early summer. The specimens we collected have improved our understanding of aspects of the biology of the species, for example, we now know it to be apterous (flightless). The species exhibits very long legs relative to body size, perhaps an adaptation for its arboreal existence and is likely to be a poor disperser, (being apterous), and may only be capable of dispersing to trees with abutting foliage. Discounting the pitfall trapped specimens, the remaining sixteen have all been collected from *N. cunninghamii* and we speculate that the adults may be host-specific to this tree species.

Further correspondence with Simon Grove who, having viewed collections and consulted with entomologists at ANIC, reveals that the species is not *Enchymus*, but more closely allied to the genus *Gastrocis* in the sub-family Leptopiini. Clearly the classification of this species remains in question. Hopefully, the specimens we provided to TMAG will assist in the clarification of the taxonomy of this cryptic weevil.

In the coming season it is our intention to begin surveys in late October, to revisit known sites and once positive results are achieved, to radiate outward, surveying a variety of tree species in an effort to better understand the occurrence and ecology of the elusive Weldborough Forest Weevil.

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Dead wood matters – a snapshot in time of one hectare of the floor of a *Eucalyptus obliqua* forest in Southern Tasmania

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Abstract

Wildfires in wet eucalypt forests, depending on their intensity and frequency, generate dead wood of varying sizes and in many different stages of decay. Windthrow events also contribute to large dead wood lying on the forest floor. In this study, CWD (coarse woody debris), defined as dead wood at least 10 cm diameter and 1 m long, and dead standing trees (stags) were measured and their attributes recorded in four 50 x 50 m plots within ca. 1 km of each other but with differing wildfire histories in a tall, wet, native *Eucalyptus obliqua* forest in southern Tasmania. Maps of the CWD and stags for each of the four plots were drawn and show substantial differences between the four plots. Information from four other surveys of CWD in the same forest type provided a degree of replication to this study. Comparisons among the studies showed that the CWD volumes in plots of similar age since wildfire were very variable and most likely reflect the chance location of large fallen eucalypts in the plots. This suggests that more surveys such as these are needed to determine the average CWD volumes in these forests. Knowledge of these volumes is required to develop forest dynamics models to predict the amount of CWD that would be present as a result of various disturbance and management scenarios. Dead wood is seen to be an important resource in these tall, wet forests, harbouring biodiversity and storing carbon. The challenge for the Tasmanian forest industry in the future may involve the development of energy-efficient methods so that mixed forests, which store carbon to a greater extent than pure eucalypt forest or pure rainforest, can produce wood products such as furniture, floors, veneers and musical instruments and do it in a manner that minimises carbon loss, to make no net contribution to global warming.

Introduction and background

Dead wood in forest ecosystems has been recognised for some time as being important in providing a range of ecological niches that maintains many specialist wood-dwelling species such as beetles, slime moulds and fungi, and houses hollow-dependent birds and mammals, as well as serving as a temporary sink for forest carbon and other elements (e.g. Harmon *et al.* 1986; Grove *et al.* 2002; Stokland & Sippola 2004; Wu *et al.* 2005). In a forest ecosystem, dead wood consists of all dead natural structures of woody plant origin, which includes dead roots, stumps, fallen tree trunks, branches, twigs, and standing dead trees (stags). Natural mortality of a tree occurs due to ageing and suppression caused by competition as the stand develops after disturbance. The disturbance may be natural (e.g. windthrow, wildfire, earthquakes) or caused by humans wanting to harvest timber, pulpwood and firewood. The quantity of dead wood input into the ecosystem following any of these disturbances may be large and immediate as with a catastrophic event or a more gradual process in time, which may be seasonal, annual or long-term (Harmon *et al.* 1986). Spatial input may be within stands or across landscapes and catchments. However, most inputs of dead wood occur at the local scale (e.g. within one tree length of the source). Knowledge of the natural dynamics of dead wood provides important baseline data that can be used for developing and evaluating strategies to lessen the pressure of human-caused disturbance on wood-inhabiting organisms (Jonsson 2000). It is customary to divide dead wood into coarse woody debris (CWD) and fine woody debris (FWD), but the dividing line between these categories depends upon the investigator. In the present study, CWD was defined to be all pieces of dead wood ≥10 cm diameter and ≥1 m length, a modification of the recommendation of Harmon & Sexton (1996). This definition of CWD included stumps, suspended pieces of wood, and shards (shattered pieces of larger logs) as well as fallen trunks and branches on the forest floor.

In Australian eucalypt-dominated forests, fire is the major cause of large-scale natural disturbance. Wildfires vary in type (Luke & McArthur 1978), intensity (Gill 1997), size, frequency and homogeneity (Ashton 1981), resulting in differing starting points for new stand development. There is generally a lack of knowledge regarding the log accumulation rate, i.e. the time frame over which trees fall and become logs on the forest floor, the rates of log decay and how these rates differ between managed and unmanaged forests in Australia (Lindenmayer *et al.* 2002). This lack of knowledge makes it difficult to determine how long it may take logged areas to accumulate volumes of CWD equivalent to pre-harvesting levels and to establish silvicultural regimes that ensure that forests are sustainably managed (Lindenmayer *et al.* 2002).

In the commercially important wet lowland eucalypt forests of southern

Tasmania, mature trees of *Eucalyptus obliqua* (stringybark) frequently attain a height of over 70 m (Kirkpatrick & Backhouse 1981), enabling these forests to produce a wood volume per hectare which is amongst the highest produced by any forest in the world (Woldendorp & Keenan 2005). Mortality in these forests results not only from catastrophic fire, but also in developing stands through natural selection and suppression of smaller, weaker individuals. These smaller stems are commonly killed by insect and fungal attack or a combination of these factors and produce smaller diameter dead wood. Smaller diameter CWD may also accumulate from branch wood that has fallen from the canopy. In these forests, wildfires that do not result in stand replacement occur more frequently than stand-replacing wildfires (Alcorn *et al.* 2001; Turner *et al.* 2009). This has resulted in a mosaic of multi-aged forest stands of largely unknown dead wood complexity.

We believe that dead wood matters. As recognised by Yee *et al.* (2001), Grove (2009b) and Wardlaw *et al.* (2009), large diameter decaying logs, a characteristic feature of unmanaged wet sclerophyll forests in Tasmania, are an extremely valuable biological resource, belying the attitude that they are just "waste wood" and therefore suitable for little else other than to be burnt to generate electricity. Grove (2009a) summarised the first decade of research at the Warra LTER into how the option for generating electricity from harvest residues might impact upon the biodiversity associated with CWD, originally mainly saproxylic beetles, but later encompassing wood-inhabiting fungi, macrofungi in general, bryophytes, and other insects and invertebrates besides beetles. Wet eucalypt forest has recently been estimated to have an average carbon density of 378 tonnes C/ha, which occurs as the forests transition to mixed forest (eucalypt overstorey and rainforest understorey) (Moroni *et al.* 2017). If left undisturbed, these mixed forests eventually transition to rainforest, when the forests can lose more than half their bole wood volume and biomass as a consequence of rainforest trees being smaller than eucalypts, with the majority of the lost wood ending up as CWD. Maximising carbon stocks at the landscape level may require periodic disturbance in the form of harvesting for wood products such as furniture, boats, housing, veneers, fence posts, musical instruments and a whole host of other utilitarian and aesthetically pleasing products. Grove (2009a) coined a new word, "deadwoodology", and he recognised that the full implications for forestry of the growing awareness of carbon budgets are still to be discovered. He concluded that the study of dead wood was certain to play a part in understanding the role of carbon in the environment.

Volumes of CWD and numbers of stags are two of the attributes used to measure stand structure and which provide quantitative evidence of habitat that can be used in biodiversity studies (McElhinny *et al.* 2005). The volume input, connectivity (in space) and continuity (in time) of CWD are important considerations in sustainable forest management (Grove *et al.* 2002). In the present study, we recorded and mapped the dead wood present in a tall wet *E. obliqua* forest in southern Tasmania containing stands resulting from different wildfire events and we compared the CWD volumes from this snapshot in time with available information from four other studies (Woldendorp *et al.* 2004; Yee 2005; Sohn 2007; Thauvin *et al.* 2010) carried out in the same forest type.

Methods

Study area

The study area was at the Warra Long Term Ecological Research (LTER) site in the Huon River valley, southern Tasmania, Australia, where four 50 x 50 m plots were established in March–April 2006 along the 'Bird Track' (see Figure 1; the track received its name from the fact that it was used for an earlier study of the birds of this area). The plots were all within ca. 1 km of each other (ca. lat./long. S 43º 06', E 146º 39') and had similar south-facing aspect, altitude, rainfall and temperature, but differed in their wildfire histories. Documented accounts, maps of fire history and fire scars on *E. obliqua* trees were used to determine age since fire (Turner *et al.* 2007). Time since wildfire for each of the four plots was estimated, respectively, to be at least 200 years (named 'Old growth'), 108 years (named '1898' as it was burnt by a fire in 1898, but later it was discovered that a part of it had also been burnt by a fire in 1934), 72 years (named '1934', burnt by a fire in 1934) and 108 years/72 years (named '1898/1934', burnt by fires in 1898 and in 1934). Plot names are used for convenience but also reflect, at least to some extent, the disturbance history of the plot.

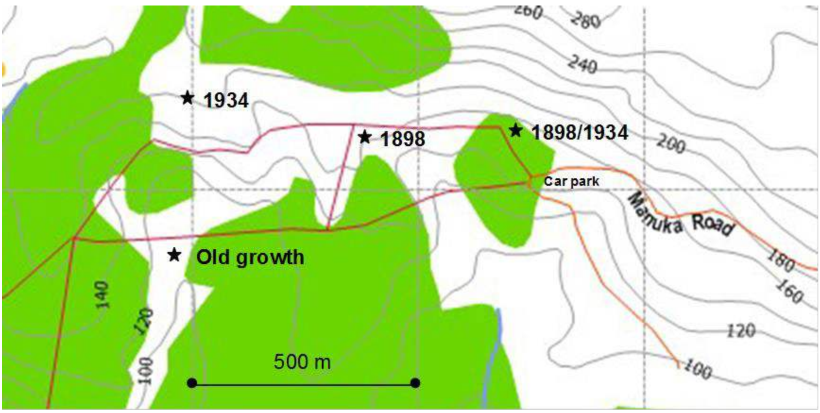

Figure 1. Location of the four plots used in this study along the 'Bird Track', Warra LTER site.

Each 50 x 50 m plot was established in the following way. Star pickets were placed at 10 m intervals along the outer boundaries of the two opposite sides of the plot. Twine was strung from the star pickets across the plot and fibreglass rods were placed at 10 m intervals along the twine to divide the plot into 25 subplots each measuring 10 x 10 m. This facilitated mapping of the CWD and stags.

CWD mapping

CWD originating from all woody perennial species was included in the study. CWD was consecutively numbered within each subplot. If a piece of CWD traversed two or more subplots, its length was measured to the boundary of the subplot and it was renumbered as a separate piece of CWD in the adjacent plot. The position, orientation and attributes (see below) of every piece of CWD in each subplot were recorded for each of the four sites. This information was transcribed onto large sheets of graph paper (laminated to make them usable in wet weather) marked with plots and subplots at a scale of 1 mm equal to 10 cm. The following attributes of each piece of CWD were recorded: 1) CWD length (cm); 2) CWD diameter (cm) measured at the mid-point of the piece of CWD; 3) CWD decay class (using a scale from 1 to 5 with intervals of 0.5; see Table 1a); and 4) percentage bryophyte cover on each piece of CWD (a visual score of 0–100%). Stumps were measured for decay class, height and mid-diameter (i.e. the diameter mid-way between the ground and top of stump).

The system of decay classes used in the Northern Hemisphere for their dead wood species had to be modified to accommodate the different wood species found in Tasmania and their differing rates of decay. In particular, the decay classification for CWD used here (Table 1a) was devised to try to overcome the problems associated with the unevenness of the interval between decay classes 3 and 4. If a piece of CWD had more than one decay class, an average was taken (after Pyle & Brown 1999). For analysis, CWD was placed into the following diameter classes: ≤15 cm, 15–30 cm, 30–60 cm, 60–90 cm, 90–120 cm, 120–150 cm, >150 cm. These classes were deemed to be most useful in forest management by Forestry Tasmania (Simon Grove, pers. comm.; Yee 2005). During analysis, other variables were derived from length and diameter by calculation, viz. volume and surface area, assuming that the shape of a piece of CWD approximated a cylinder. For stumps, height replaced length.

Stag mapping

Stags were recorded in a similar way to CWD, except 1) height was used in place of length; 2) diameter was measured at breast height; 3) decay was assessed using a modified system to that used for CWD, see Table 1b, following Cline *et al.* (1980), Spies *et al.* (1988) and Motta *et al.* (2006).

Statistical analyses

The statistical analyses were mainly descriptive, producing summary statistics. As the CWD was measured within each subplot, this enabled certain statistics such as minimum and maximum subplot volumes to be calculated for each plot, and also proved useful in a subsequent survey of the macrofungi growing on wood (see Gates *et al.* 2011). At the plot level, the results presented here mostly used composite pieces of CWD, obtained by concatenating the information on pieces of CWD that crossed subplot boundaries. Graphical methods involved one variable at a time for percentage of pieces of CWD in each decay class and percentage bryophyte cover on CWD. Stags were examined by calculating the number of stags and their diameters in each plot and by recording the number of stags in each percentage bryophyte cover class.

Table 1. CWD and stag decay classification to accommodate *E. obliqua* and other tree species. (a) CWD, (b) Stags.

Decay class	**(a) CWD: Characteristics for classifying CWD**
1	CWD freshly downed, entire, cylindrical, wood hard, sound, bark intact, no sign of internal decay or external macrofungal fruit bodies.
1.5	Wood has been lying on the ground for some time, cracks appearing in bark.
2	CWD remaining solid, losing some bark, some macrofungal fruit bodies appearing, bryophyte cover sparse.
2.5	CWD with many macrofungal fruit bodies, but exhibiting no sign of softening. Category included to accommodate *Pomaderris apetala*.
3	CWD retaining round shape, bark may be present, bryophyte cover present but variable, some degree of heart rot, still quite firm on the outer surface, many external macrofungal fruit bodies present in season.
3.5	CWD beginning to flatten, becoming softer, often with seedling trees, wood-inhabiting macrofungal genera being commonplace, bryophyte cover substantial. Roots from nursery trees making their first appearance.
4	CWD half its original diameter, often with only the sides remaining but still recognizable as a log or a log that may be prolifically interspersed with roots from nursery trees of considerable size.
4.5	CWD disintegrating into splinters and losing outline.
5	CWD reduced to a pile of humus, still with very small wood fragments present, outline just visible, mound-like appearance or a 'cage' of roots from a nursery log with some woody humus remaining.

Decay class	**(b) Stags: Characteristics for classifying stags**
1	Stag limbs and branches all present; 100% bark present.
2	Stag has some loss of limbs and bark but is sound at base.
3	Stag distinctly rotten at base; in *E. obliqua* the bark can still be intact at this stage.
4	Stag still standing with outer bark intact but obviously very decayed inside. This category is for *Nothofagus* stags.
5	Stag reduced to a thin central core, no outer wood but still standing. This category is for *Nothofagus* stags.

Results

CWD maps

Maps showing the positions of CWD in each plot are given in Figure 2. Of the total of 814 pieces of composite CWD, 227 pieces were in 'Old growth', 138 in '1898', 212 in '1934' and 237 in '1898/1934'. The relative sparseness of pieces of CWD in '1898' (Figure 2b) compared with the other plots is readily observable.

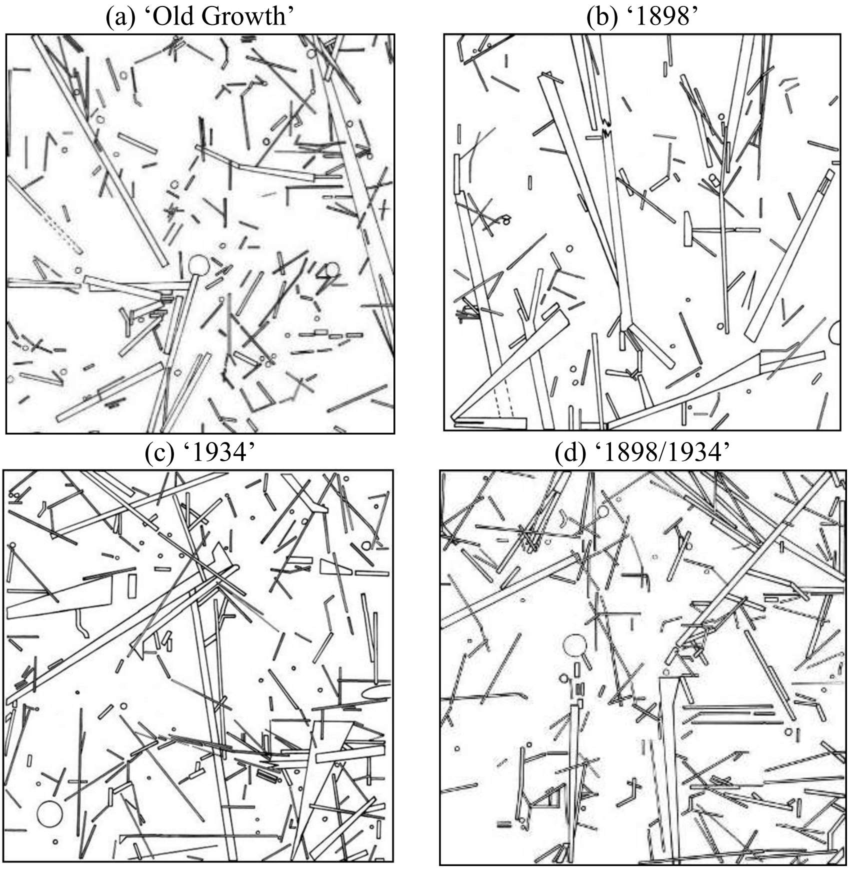

Figure 2. Maps of the CWD in the four plots at the Warra 'Bird Track'. Stags are represented by circles. Large diameter and long CWD are drawn to scale in these 50 x 50 m plots (very small CWD may be represented as larger than their true size at this scale).

CWD attributes versus diameter class

Figure 3 displays the percentages of pieces of CWD in each diameter class for each plot separately and for all plots combined. The greatest discrepancy occurs in the diameter class 15<D≤30 cm between 'Old growth' (109 pieces of CWD) and 1898 (39 pieces of CWD in that class) or, in percentage terms, 48% vs. 28.3%. 'Old growth' and '1934' each have their maximum in the 15<D≤30 cm diameter class, whereas for '1898' and '1898/1934', their maximum occurs for the smallest diameter class (D≤15 cm) and progressively declines with increasing diameter class. In 'Old growth', almost all of the CWD was in low diameter classes, with only 7.1% of its pieces of CWD having a diameter ≥60 cm, contrasting with '1898' which had 15.9% of its pieces of CWD in the large diameter classes of 60 cm or more.

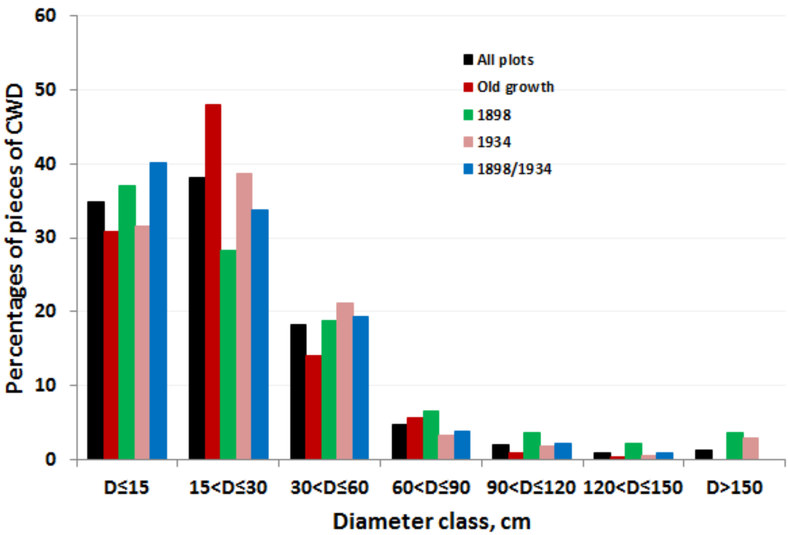

Figure 3. Percentage of pieces of CWD in each diameter class for each plot separately and for all plots combined. The percentages add up to 100% within a plot. The greatest discrepancy among plots occurs in the 15<D≤30 cm diameter class, where the contrast between the 'Old growth' and the '1898' plots is noteworthy.

CWD attributes versus decay class

Most of the 814 pieces of composite CWD within the four plots fell in the middle decay classes (DC3 and DC3.5), with 522 pieces of CWD (64.1%) in these combined classes (Figure 4). 'Old growth' had a very small percentage of CWD in the lower decay classes (DC≤2.5) compared with younger plots, but this was compensated for in the higher decay classes (DC≥4). Bryophyte cover tends to increase steadily as decay class increases in units of 0.5 from DC1–DC5 in all plots combined (Figure 5). Slightly deviating from the overall trend is '1934', which reaches a plateau at a percentage bryophyte cover of ca. 50% in the higher decay classes.

CWD and stag volumes

For each plot separately, minimum, median and maximum CWD subplot volumes are given in Table 2, which also gives the total plot volumes. Based on total volume (m^3/ha) of CWD present, '1898' had more than twice the volume of '1898/1934', whereas for stags (Table 3), '1898' had the lowest volume.

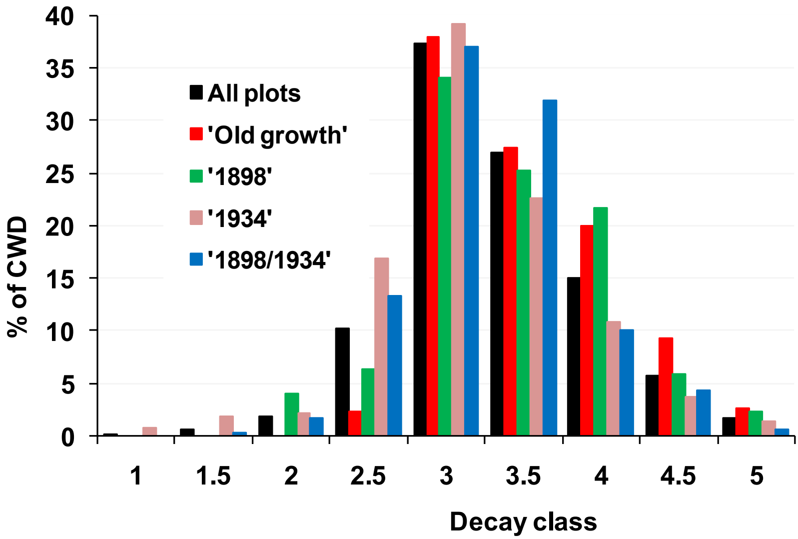

Figure 4. Percentage of pieces of CWD in each decay class for each plot separately and for all plots combined. The percentages add up to 100% within a plot. Noteworthy is the paucity or lack of 'Old growth' CWD in the low decay classes.

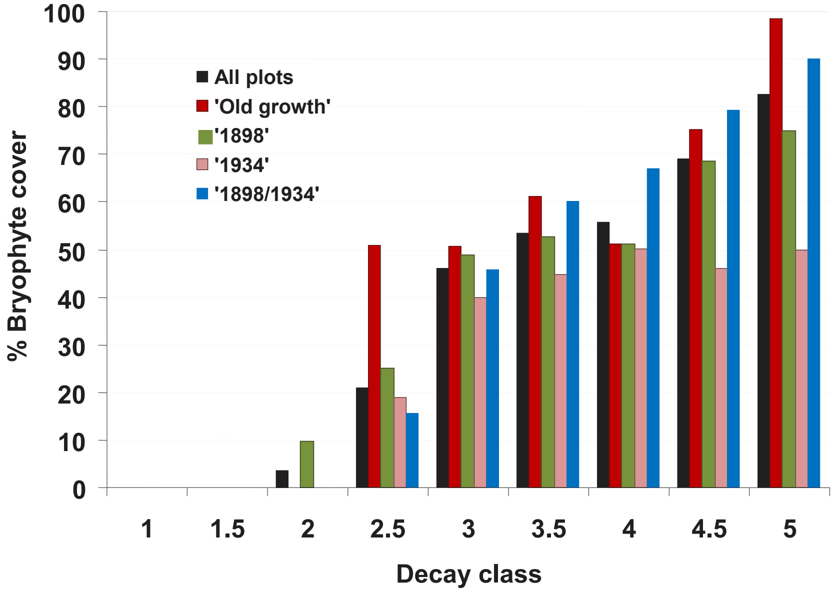

Figure 5. Average percentage bryophyte cover on CWD in each decay class for each plot separately and for all plots combined. The general trend is for an increase of bryophyte cover with increasing decay class, the exception being the '1934' plot which peaks at DC=4 and then levels off.

Table 2. Subplot minimum, median and maximum volume of CWD (in the 25 subplots) for each of the plots 'Old growth', '1898', '1934' and '1898/1934', and the total volume and total volume/ha for the same plots.

	'OG'	**'1898'**	**'1934'**	**'1898/1934'**
Minimum volume m^3	0.63	0.43	0.26	0.26
Median volume m^3	3.72	13.53	9.68	6.71
Maximum volume m^3	34.4	45.9	37.1	21.1
Total volume m^3	209.5	361.7	272.7	175.3
Total volume m^3/ha	**838**	**1447**	**1091**	**701**

Stag numbers and attributes

The '1934' plot had the greatest number of stags, closely followed by 'Old growth', while '1898' had the least number (Table 3). Although '1934' had 34 stags, all but one of them was of small diameter (Figure 6), so that the stags of that plot had the smallest average diameter of the four plots (Table 3). In contrast, although '1898/1934' had only 20 stags, that plot had the highest average diameter due to four stags of large diameter, each >100 cm (Figure 6). 'Old growth' had two large diameter stags (Figure 6), giving it the second largest average diameter (Table 3). With respect to species composition, there is a sharp contrast between the younger stands, '1934' and '1898/1934', which had 16 and 12 *E. obliqua* stags, respectively, and the mature forests, '1898' and 'Old growth', which had only one *E. obliqua* stag each (Table 3). The identifiable stags in 'Old growth' are mainly of *Nothofagus cunninghamii* (myrtle beech), *Atherosperma moschatum* (sassafras) and *Acacia melanoxylon* (blackwood), all of which are typical rainforest species.

The number of stags as a function of bryophyte cover class and plot is shown in Figure 7. Increasing bryophyte cover is associated with increasing age of plot, with few stags in '1934' and '1898/1934' having bryophyte cover of 25% or more.

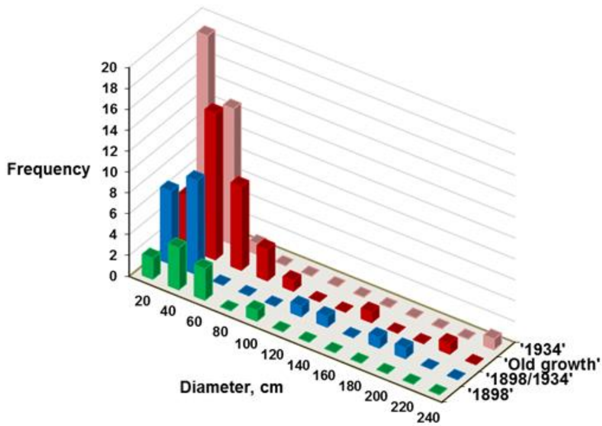

Figure 6. Diameter distribution of stags in the four plots at the Warra 'Bird Track'. Although plots '1934' and 'Old growth' had almost the same number of stags (34 vs. 33), those for '1934' were mostly concentrated in the two lowest diameter classes (D≤40 cm), whereas 'Old growth' had more stags in the higher diameter classes. Like plot '1934', '1898/1934' also had the majority of its stags in the D≤40 cm classes, but it also had four stags with diameters 1.0 m or greater. Plot '1898' had few stags.

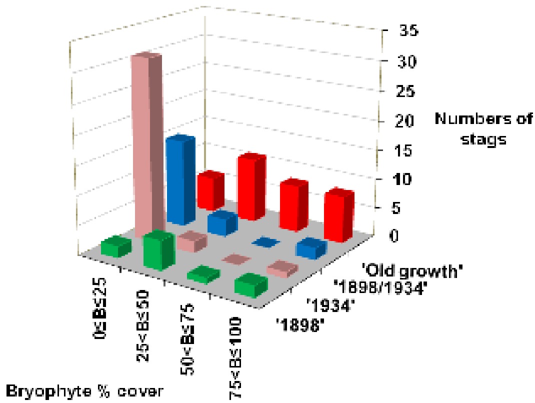

Figure 7. Stag numbers in bryophyte percentage cover classes. There is a stark contrast between the younger plots '1934' and '1898/1934', which had most of its bryophyte cover in the B≤25% class, and the more mature plots 'Old growth' and '1898', which have greater percentages of bryophytes in the higher cover classes.

Table 3. The total number of stags, number of *E. obliqua* stags, average stag diameter and total stag volume in the four plots.

		Plot		
	'Old growth'	**'1898'**	**'1934'**	**'1898/1934'**
Total no. of stags	33	10	34	20
No. of *E. obliqua* stags	1	1	16	12
Ave. stag diam., overall, cm	48.3	39.9	28.5	50.2
Ave. stag diam., eucalypts, cm	150	25	34.7	23.2
Volume of stags, m^3/ha	**226**	**47**	**192**	**176**

Volumes of CWD from other studies

Sohn (2007) measured the volumes of CWD in plots of the chronosequence study of Turner *et al.* (2007). Of interest here are the four plots having a southerly aspect, viz. '1966S', '1934S', '1898S' and 'OGS'. Although these plots were of size 50 x 50 m, as in the present study, Sohn (2007) used a lower diameter limit of 40 cm, thereby obtaining volumes that are somewhat lower than if a 10 cm lower diameter, as in the present study, had been used. The CWD volumes from these plots, corrected for their reduction in volume resulting from the use of a different lower diameter limit, is given in Table 4. Woldendorp *et al.* (2004) inventoried the CWD in two wildfire-affected plots in the tall wet *E. obliqua* forests of the Warra LTER, both having a southerly aspect and which were not amongst the four plots of the present study nor amongst the four plots of a southerly aspect measured

Table 4. Volumes of CWD from the plots of the present study, and from those of Woldendorp *et al.* (2004), Yee (2005), Sohn (2007) and Thauvin *et al.* (2010), all of which come from mature unlogged forests. Volumes include downed wood and stumps, but exclude stags.

Plot ID	Age, yr	CWD volume, m^3/ha	Source of data
'1966S'	41	408 (510)	Sohn (2007)
'TAS3'	58	744	Woldendorp *et al*. (2004)
'PO1'	67	876	Yee (2005)
'PO2'	67	769	Yee (2005)
'TAS2'	68	1236	Woldendorp *et a*l. (2004)
'1898P'	72	1431	Present study
'1934'	72	1091	Present study
'1898/1934'	72	701	Present study
'1934S'	73	539 (674)	Sohn (2007)
'1898S'	73	360 (450)	Sohn (2007)
'WR'	87	847	Yee (2005)
'M'	95	938	Yee (2005)
'R'	95	633	Yee (2005)
'1898R'	108	1481	Present study
'Old growth'	>250	838	Present study
'OGS'	>250	869 (1086)	Sohn (2007)
Mature forest	—	560	Thauvin *et al*. (2010)

The plot '1898' of the present study is divided into its two component parts, viz. '1898P' for the subplots that predominantly contain *Pomaderris apetala* and '1898R' for the subplots that predominantly contain rainforest species. CWD volumes from Yee (2005) are divided by 0.25 to convert the values measured on 0.25 ha plots to a per hectare basis. Volumes from Sohn (2007) were measured on logs having a minimum diameter of 40 cm, whereas the other studies used a minimum diameter of 10 cm. This results in an underestimation of the CWD volume by an amount estimated by Sohn (2007) as ca. 25%. Therefore, values are also given (in parentheses) which predict what the CWD volumes might have been had a minimum 10 cm diameter been used. The CWD volume for mature forest from Thauvin *et al.* (2010) is the average of 28 plots (each 50 x 50 m) of varying ages; plots derived from silvicultural regeneration are not included.

by Sohn (2007). The size of these plots was 1 ha each, i.e. four times the size of each of the plots of the present study, and the definition of CWD was slightly different, having lower diameter and length limits of 15 cm and 50 cm, respectively (instead of the 10 cm diameter limit and the 1 m length limit used here). Because '1898' of the present study is really made up of two fire histories, it was split into two parts for inclusion in Table 4, with '1898P' based on subplots where *Pomaderris apetala* (common dogwood) was the predominant understorey species, and '1898R' based on subplots where rainforest species were predominant. Yee (2005), using a line transect method, measured dead wood volumes for ten 50 x 50 m plots, but as five of those plots were in regenerated sites after logging, only the five plots from mature unlogged forests are considered here. The CWD volumes from Yee (2005, Table 2.7) are included in Table 4 after dividing by 0.25 to convert the volumes that were based on her 0.25 ha plots to m^3/ha. The most recent and comprehensive study of CWD was that of Thauvin *et al.* (2010), who used 56 plots of size 50 x 50 m, 28 of which were in silviculturally regenerated sites and 28 of which were in mature forest. Only the latter are considered here and because they did not tabulate CWD volume as a function of individual plot age, only the overall mean CWD volume 560 m^3/ha is included in Table 4. This table clearly shows the large variation of CWD volume for plots of the same or closely similar ages, wherever ages are available, especially those of 72–73 years since wildfire.

Discussion

The sources of CWD for the four plots of the present study are (1) the stand prior to the disturbance, (2) the direct result of the disturbance itself, and (3) an ensuing gradual input from the current stand, including mortality caused by disease, suppression and competition, insect attack, and windthrow. Although located within ca. 1 km of each other, the four plots have different fire histories and therefore probably have different mechanisms by which the major part of their CWD was likely to have originated. In Tasmania, in the long absence of fire and in areas where the annual rainfall exceeds 1270 mm, ecological drift occurs (Jackson 1968). This means that the wet eucalypt forests progressively becomes mixed forest as their understorey is dominated by cool temperate rainforest and, as the eucalypts die without regeneration, the eventual outcome that may take ca. 400 years to occur is climax rainforest. The 'Old growth' plot fits the definition of mixed forest (old, even-aged eucalypts, with an understorey of mature rainforest; see Gilbert 1959 and Wells & Hickey 1999). The live vegetation showed floristic simplification with a preponderance of mature rainforest species and two very large surviving eucalypts (see Gates & Ratkowsky 2016). Only one stag in 'Old growth' was of *E. obliqua* origin, compared to 32 stags of rainforest and/ or other species (Table 3). Pieces of CWD in 'Old growth' had the highest percentage bryophyte cover of all the plots, a consequence of the direct relationship between decay class of the wood and percentage bryophyte cover (Figure 5). The most likely origin of the high percentage of pieces of CWD in high decay classes (Figure 4) and of small diameter (Figure 3) in 'Old growth' was from branches breaking out of declining eucalypt crowns and from the tops of stags from climax rainforest species falling to the forest floor. The sparseness of large diameter CWD in high decay classes in 'Old growth' suggests that sufficient time (>300 yr., Grove *et al.* 2009) had elapsed for the CWD resulting from the death and falling of the original mature eucalypt stand to rot away.

The '1898' plot was made up of two distinct vegetation types. The partition '1898R', an area characterised by living rainforest species, had a CWD volume of 1481 m^3/ha, due to some very large pieces of CWD of *E. obliqua* origin that may have resulted from trees killed by an intense and possibly stand-replacing fire in the year 1898. These trees likely fell immediately after the fire or subsequently as a result of wind or disease. Any small diameter branch wood or suppressed trees of small diameter from the regenerating stand could have had sufficient time (108 years) to rot away, which may explain the relatively low percentage of pieces of CWD in the $15<D\leq30$ cm diameter class (Figure 3).

However, the stand may not have been old enough for the accumulation of small diameter CWD of the rainforest species that were found in 'Old growth'. In this rainforest partition of '1898', there were three very old *N. cunninghamii* stags consistent with an old growth plot. The partition '1898P' had a CWD volume almost as high as for '1898R', also due to a few very large diameter trees, but in a significantly lower decay class (data not shown), consistent with fallen wood being on the forest floor for a shorter period of time.

In '1934', the lower average decay class of the CWD reflects the shorter time (72 years) that the wood has been lying on the forest floor. The high number of small diameter stags (Figure 6) may reflect suppression mortality in the regenerating stand. A striking difference between the composition of the living stems of '1934' and that of '1898/1934' and of '1898P', plots or parts of plots that experienced a second fire in 1934, is the presence of *Monotoca glauca* (goldey wood) and the absence of *Pomaderris apetala* (see Gates & Ratkowsky 2016). This can be attributed to a different underlying geology. Whereas the other plots are on soils derived from Jurassic dolerite, '1934' is situated on Permo-Triassic sedimentary rock, which produces a more acidic soil type that favours *Monotoca* in place of *Pomaderris* (Balmer 2016).

The '1898/1934' plot had the smallest volume of CWD (Table 2), which is consistent with the second fire consuming the CWD generated by the first fire. Alternatively, perhaps the large diameter trees that were killed by the fire of 1898 did not fall immediately but remained as stags, which survived the fire of 1934 (see Figure 6). Any small diameter stags that resulted from regeneration after the first fire and later suppressed by competition to become small diameter CWD on the forest floor, were likely to have been consumed by the second fire. Suppression mortality in the regenerating stand following the second fire was likely to have been responsible for the many small diameter stags of *E. obliqua* origin (Table 3), similar to '1934'.

CWD volume varies greatly among forest plots that are otherwise very similar in wildfire history. Discrepancies in CWD volumes of the order of magnitude observed in Table 4, with a range of 360–1431 m^3/ha for an age of 72–73 years, cannot be attributed to differences in the lower diameter limit. That is, if a lower diameter limit of 40 cm had been used in the present study instead of 10 cm, 92.3% of the total volume would still have been observed, as the total volume is determined mainly by large diameter logs. The amount of CWD in a 50 x 50 m plot $\geq$ 72 years old regenerating in these native forests is largely a matter of chance, the main contributors to CWD volume being fallen eucalypts, some of which had heights exceeding the 50 m plot length. A single fallen tree in a 50 x 50 m area can have a big effect on CWD volume, e.g. the largest piece of CWD in 'Old growth' (clearly visible on the right-hand side of Figure 2a) accounted for 42.1% of the CWD volume in that plot. There were other large old trees and stags outside the boundary of the plot that could have randomly fallen and landed in the plot. Therefore, the fact that CWD volumes vary greatly is not surprising. Another point to note is that if all the stags had fallen to become CWD, the rank orders of the total amount of dead wood in the plots would remain unchanged, as the stag volumes in a plot are only a fraction ($\leq$21%) of the CWD volumes. That is, '1898' would still be the plot with the most total dead wood, '1934' would remain second highest, 'Old growth' would remain next and '1898/1934' would still have the least total dead wood.

The great variability in CWD volume that can occur in stands of the same age in what is ostensibly the same forest type is an impediment to the development of a stand dynamics model, that is, one that attempts to predict the long-term effects of stand-replacing fires or disturbances such as logging and fuelwood harvesting. One such model is that of Grove & Stamm (2011), who explored six disturbance scenarios, four of which were wildfire scenarios, in the same tall, wet eucalypt forest as in the present study. That deterministic model explored the effect of repeated replacement cycles over a period of 1200 years on the volume and mass of downed woody debris (DWD), of which CWD is a subset. Testing the validity of that or other simulation models using real data requires a great deal of replication, especially in view of the variability in woody debris volume that occurs in this forest type. Another impediment is the lack of a precise age for the 'Old growth' plot of the present study and the 'OGS' plot of the Turner *et al.* (2007) study, which poses difficulties for the development of a regression model. There is also a conspicuous absence of data for stand ages between 108 years and the age of the old growth stands. The experimental procedure of Sohn (2007) (see also Sohn *et al.* 2013), which used a minimum CWD diameter of 40 cm (rather than the 10 cm minimum employed in the present study) and the line transect sampling method (rather than measuring the dimensions of each piece of fallen wood) facilitated the determination of CWD volumes, thereby reducing the time it takes to survey a 50 x 50 m plot. Future studies, adopting such time-saving approaches, could provide the quantitative values for the CWD volumes in these forests that are required to test stand dynamics models and help make decisions about the management of Tasmanian wet forests with a view towards sustainability. The challenge may be to develop energy-efficient methods so that the maintenance of mixed forests is done in a manner that minimises the overall expenditure of energy, makes a minimal contribution to global warming, and maintains carbon neutrality. Tackling this challenge, and solving it, should enable Tasmania to have a viable forest industry whilst avoiding the experience of Fennoscandia, where forests denuded of CWD led to numerous life forms becoming extinct or being “red-listed”. Understanding the role that CWD plays in the Tasmanian ecosystem is the key to enlightened management.

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Highlights of pelagic birding from Eaglehawk Neck 2016/2017

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This is the sixth in a continuing series of articles summarising the highlights of pelagic sea birding off Tasmania's coast (Wakefield 2012; Wakefield & Brooks 2013; Wakefield 2014; Brooks 2015; Wakefield 2016).

From July 2016 to June 2017 there were ca. 23 pelagic trips from Eaglehawk Neck on the MV Pauletta skippered by John Males.

On 9 July 2016, David Mitford and Rob Hynson organised a pelagic that turned up some fantastic birds. The highlights were a Sooty Albatross *(Phoebetria fuscus*) and three sightings of at least two Light-mantled Albatross (*Phoebetria palpebrata*). In addition there was the largest sea bird, a Snowy Albatross (*Diomedea exulans*), more than 10 Blue Petrel (*Halobaena caerulea*), at least eight Slender-billed Prion (*Pachyptila belcheri*) and up to three Grey Petrel (*Procellaria cinerea*). Adding to the feast were five White-headed Petrel (*Pterodroma lessonii*).

The following day, 10 July 2016 with similar conditions, David and Rob reported a Light-mantled Albatross again as well as one Providence Petrel (*Pterodroma solandri*), six White-headed Petrel (*Pterodroma lessonii)* eight Blue Petrel and a Grey Petrel. The highlight however was an immature Grey-headed Albatross (*Thalassarche chrysostoma*).

The following weekend Rohan Clarke organised two Birdlife Australia trips. I was lucky to be on the first one on the 16 July which was the more exciting. The weather was clear and sunny with nice soft winter light for photography. It was cool to mild (not cold!) which is exceptional for a mid-winter pelagic off Tasmania. The highlights were a showy Grey Petrel, a Soft-plumaged Petrel (*Pterodroma mollis)*, a White-headed Petrel and an immature Salvin's Albatross (*Thalassarche salvini*). Rohan commented that 24 species of seabird beyond the breakwater indicated slightly below average diversity. In comparison there had been a total of 26 species for both trips on the previous weekend.

Sunday 17 July was also clear and sunny but although it was cool to mild at first, the weather became cold with the stronger breeze around midday. Rohan commented that there were only 18 species of seabird beyond the breakwater which was well below average for a Tassie pelagic. There was only one highlight, a White-headed Petrel.

Paul Brooks led the next pelagic on 21 August 2016. In his trip report Paul commented "The prevailing northerlies in the week leading up to the trip left us less than optimistic about the chances of seeing many of the subantarctic specialties and our fears were in the main proven correct". Although not listed as a highlight by Rohan there had been three Cape Petrel (*Daption capense*) on 16 July but on this trip they were noted for their absence. The few highlights were three Northern Royal Albatross (*Diomedea sanfordi*) two of which stayed around the boat for some time and a single Grey Petrel.

September is often the best month for diversity on pelagics and this year was no exception. Rohan Clarke organised two Birdlife Australia trips that were cool to cold on 10 and 11 September 2016. On Saturday there were 37 species of seabird beyond the breakwater indicating exceptional diversity. This could be because of the wind from the SW which increased from 15 knots in the early morning to a maximum of 20 knots beyond the shelf. Highlights were a couple of quick passes by the boat of a Broad-billed Prion (*Pachyptila vittata*) that was only the second record for the trips out of Eaglehawk Neck, a Salvin's Prion (*Pachyptila salvini*), four Grey Petrel that hung around for a few minutes, five White-headed Petrel and a Providence Petrel.

On Sunday 11 September 2016, the wind came from the NW rising to a maximum of 15 knots and 32 species were recorded beyond the breakwater again indicating excellent diversity. The clear highlight was an Antarctic Tern (*Sterna paradisaea*) that made several passes of the boat in pelagic waters. Soft- plumaged, Providence and White-headed Petrels were also nice as were 10 species of albatross including many great albatross and two Salvin's Albatross.

Paul Brooks led the following pelagic on 8 October 2016. A single Antarctic Tern (*Sterna vittata*) was an obvious highlight, being the fourth record for Tasmania, the third record for the last 2 years and the ninth for Australia pending acceptance by BARC (Birds Australia Rarities Committee). The bird was moulting into breeding plumage and flew by the port side of the boat close enough to allow for identifiable photographs. The adult Salvin's Albatross was another highlight as was the high concentration of Grey-backed Storm Petrel (*Garrodia nereis*) feeding in our slick throughout the day.

On 19 November 2016 I organised a private trip to show my two visiting Canadian friends our Tasmanian seabirds. We enjoyed sunny conditions and light winds which to our surprise brought in many large albatross. Most

Plate 1. Antarctic Tern photographed on 11 September 2016. Photograph: Els Wakefield.

were Southern Royals, and two other highlights were a Northern Royal Albatross and a Soft-plumaged Petrel. There were also 11 Wilson's Storm Petrel (*Oceanites oceanicus*) and 28 Fairy Prion (*Pachyptila turtur*). Although local birders would have expected to see a greater variety of birds, the good views were especially satisfying for our visitors.

The following day, Sunday 20 November 2016, Inala Tours held a pelagic on which two Humpback Whales, a mother and a calf, were observed fluke-slapping and lolling around inshore in the afternoon. The calf breached separately as the two moved off to the south. They also had seven Long-finned Pilot Whale, about 15 Oceanic Bottlenose Dolphin and approximately 20 Short-beaked Common Dolphin. Among the birds there were two Southern Royal Albatross and a Parasitic Jaeger (*Stercorarius parasiticus*). However, Paul Brooks and Mark Holdsworth observed an Australasian Gannet carrying what was believed to be nesting material to the Hippolyte, the large rock on the way to the shelf. This caused great interest as there are no previous records of Australasian Gannets attempting to breed on the Hippolyte despite the presence of large numbers roosting and flying there.

A subsequent Inala trip on 30 November 2016 was an excellent trip with highlights of three Mottled Petrel (*Pterodroma inexpectata*), one Salvin's Albatross, one Soft-plumaged Petrel, one White-headed Petrel and three Parasitic Jaeger. Paul noted there was no evidence of Australasian Gannets breeding.

The trip on 10 December 2016, was organised by Paul Brooks, who found no evidence of breeding of Australasian Gannets on the Hippolyte. Paul reported that the conditions were again quiet in terms of number and diversity of species with no *Pterodroma spp.* recorded (apart from a very distant, unidentified bird seen by a couple of observers). Highlights were a lovely immature Wandering Albatross and a pod of about 10 Long-finned Pilot Whales.

The pelagic on Sunday 8 January 2017 was led by Paul Brooks. There was again no breeding activity of the Australasian Gannets observed on the Hippolyte. A steady north easterly wind blew in three Wedge-tailed Shearwater (*Ardenna pacifica*) together although there could have been up to six birds. These are a very rare sight in Tasmanian waters. Additional highlights included a very showy Black-bellied Storm Petrel (*Fregetta tropica*), a 'lifer' for some, that foraged in the slick for about 15 minutes to allow excellent, close views. At 70 fathoms, a single Buller's Shearwater (*Ardenna bulleri*) approached from the stern and flew by, giving good views and another bird flew by quickly over 85 fathoms. These unusual birds made for a very exciting trip.

Rohan Clarke organised another Birdlife Australia pelagic on Friday 27 January 2017 on which a pod of three well photographed Shepherd's Beaked Whales were spotted in over 460 fathoms. This was possibly the 15th documented at-sea sighting globally and the third sighting off Eaglehawk Neck (see Shepherd's beaked whale *Tasmaceus shepherdi*: the first confirmed live sightings Wakefield 2012). There were 26 species of birds, about average for a Tasmanian pelagic. Particularly notable were the good numbers of storm petrel with up to 50 White-faced Storm Petrel (*Pelagodroma marina*) and 70 Grey-backed Storm Petrel (*Garrodia nereis*), the Southern Royal (*Diomedea epomophora*) and Antipodean Albatross (*Diomedea gibsoni*) and according to Rohan an unusual January record of a Brown Skua (*Stercorarius antarcticus*). There was also an Arctic Jaeger (*Stercorarius parasiticus*) inshore in the morning.

On Saturday 28th January 2017 Rohan led a second trip for the weekend and in his report Rohan commented that the similarity between the two days in both the species list and the numbers involved was striking although sadly, there were no Shepherd's Beaked Whales sighted this time. The highlight was an immature Southern Royal Albatross allowing good photos in the mild conditions.

Plate 2. Wedge-tailed Shearwater, note very long tail, photographed 8 January 2017. Photograph: Els Wakefield.

On 4 February 2017, a young visitor from The Netherlands and I were lucky to be able to join a pelagic as part of Philip Maher's annual wildlife tour of Tasmania. Phillip's report reads that a single Wedge-tailed Shearwater flew by the back of the boat but only did the one pass. This was Phillip's first sighting of a Wedge-tailed Shearwater off Tasmania in nearly thirty years of pelagics and the second sighting for Tasmania this year.

On another Inala pelagic trip on 18 February 2017, Paul Brooks reported that bird diversity was low perhaps due to light winds although there were up to 70 White-faced Storm Petrel. The highlight of the day was that four chicks were observed amongst a group of roosting Australasian Gannets. This constitutes the first confirmed breeding record for this species on the Hippolyte.

On Sunday 5 March 2017, the pelagic was organised by Paul Brooks but he was unable to attend so Mona Loofs-Samorzewski compiled the report. Around the Hippolytes there was plenty of breeding activity by Australasian Gannets (*Morus serrator*) and a banded adult was also discovered from photos. No stand-out species were recorded and the highlight was a young Wandering Albatross that was banded on the left leg.

On 10 March 2017 I organised a private trip for our Dutch visitor and Peter Vaughan kindly wrote the report. Surprisingly a single Cattle Egret (*Bubulcus coromandus*) was spotted on the Hippolyte but the highlight of the day was on the return trip when the skipper was asked to return to the rock but to stand back to allow photographs to be taken of the top of the island. This resulted in the exciting find of the new group of 43 Australasian Gannets breeding on top of the rock now encompassing two small colonies, one with 8 chicks and one with 6 chicks. Also a further four young birds were observed in flight inshore, including at least one first year bird.

There was a stand out double highlight on 20 and 21 May led by Bernie O'Keefe. On the Saturday, despite very rough conditions all on board were treated to a Light-mantled Albatross, one Grey Petrel and two Westland Petrel (*Procellaria westlandica*).

The following day, Sunday 21 May, I was lucky enough to be offered a place as a second rough day at sea was too much to face for one of the participants. After a wet start and rough conditions, we were treated to a Blue Petrel, two Westland Petrel, one Southern Fulmar and a Providence Petrel.

On Saturday 27 May the Pauletta headed out in strong northerlies of 15 to 20 knots. The swell was over 2 metres at times, combining with another swell of 1 to 2 metres providing us with a rough trip. Paul Brooks was hoping to replicate Bernie O'Keefe's fantastic two trips the previous weekend. Luckily no one was seasick and perhaps because of the rough conditions, we did enjoy some good birds but they were not the same as the weekend earlier. Highlights were a Slender-billed Prion, two White-headed Petrel, a Soft-plumaged Petrel and a Grey Petrel that gave excellent views as it repeatedly flew right over the back of the boat before stopping to forage in the slick, even sitting on the water and staying with us for over an hour.

On Sunday 28 May we headed out minus Paul who was unable to attend so Mona Loofs-Samorzewski compiled the report. Unfortunately the forecast winds did not happen and the only notable sighting was a double raft of roughly 200 Fairy Prions. It was a lovely day out at sea that we all enjoyed. Just being out there is a thrill and good views of birds are an added bonus. There is always the next pelagic....

Acknowledgements

Thanks to Paul Brooks for his assistance

Plate 3. A and B First breeding record of Australasian Gannets in two separate colonies on Hippolyte Rock 10 March 2017. Photograph: Els Wakefield.

with this report. Thanks also to Paul Brooks, Mona Loofs- Samorzewski, Rohan Clarke, Phil Maher, Bernie O'Keefe, David Mitford and Rob Hynson for their trip reports and thanks to our excellent skipper, John Males and his crew.

Plate 4: Grey Petrel taken 27th. May 2017. Photograph: Els Wakefield.

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Appendix

Bird species list pelagic highlights 2016/2017 IOC taxonomy

Procellariformes

Diomedeidae, Albatrosses

1. Wandering Albatross (*Diomedea exulans*)
2. Antipodean (Gibson's) Albatross (*Diomedea antipodensis gibsoni*)
3. Southern Royal Albatross (*Diomedea epomorpha*)
4. Northern Royal Albatross (*Diomedea sanfordi*)
5. Sooty Albatross (Phoebetria fusca)
6. Light-mantled Albatross (*Phoebetria palpebrata)*
7. Salvin's Albatross (*Thalassarche salvini*)
8. Grey-headed Albatross (*Thalassarche chrysostoma)*

Procellariidae, Petrels, Shearwaters

9. Cape Petrel (*Daption capense*)
10. Blue Petrel (*Halobaena caerulea*)
11. Slender-billed Prion (*Pachyptila belcheri*)
12. Fairy Prion (*Pachyptila turtur*)
13. Broad-billed Prion (*Pachyptila vittata*)
14. Salvin's Prion (*Pachyptila salvini)*
15. White-headed Petrel (*Pterodroma lessonii*)
16. Providence Petrel (*Pterodroma solandri*)
17. Soft-plumaged Petrel (*Pterodroma mollis*)
18. Grey Petrel (*Procellaria cinerea*)
19. Mottled Petrel (*Pterodroma inexpectata)*
20. Wedge-tailed Shearwater (*Ardenna pacificus*)
21. Buller's Shearwater (*Ardenna bulleri*)
22. Westland Petrel (*Procellaria westlandica)*.

Hydrobatidae, Storm Petrels

23. Wilson's Storm Petrel (*Oceanites oceanicus*)
24. Grey-backed Storm Petrel (*Garrodia nereis*)
25. White-faced Storm Petrel (*Pelagodroma marina*)
26. Black-bellied Storm Petrel (*Fregetta tropica*)

Areidae, Herons, Bitterns

27. Eastern Cattle Egret (*Bubulcus coromandus*)

Sulidae , Gannets, Boobies

28. Australasian Gannet (*Morus serrator*)

Laridae, Terns

29. Antarctic Tern (*Sterna vittata*)

Stercorariidae, Skuas

30. Brown Skua (*Stercorarius antarcticus*)
31. Parasitic Jaeger (*Stercorarius parasiticus*)

The declining native land snail fauna of Poimena Reserve, Austins Ferry, Tasmania

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Abstract

This paper documents the native land snail fauna of Poimena Reserve, Austins Ferry, a small urban bushland reserve in Hobart's northern suburbs. Evidence of thirteen native land snail species was found in surveys between 1990 and 2017. However, several of these species records consist of old dead shells only, while at least one species common when surveying commenced has at least declined greatly, if not become locally extinct. The reserve appears to be in a process of transition to a depleted native land snail fauna dominated by the family Punctidae. Possible causes of decline include burning, exotic predators including *Oxychilus* snails, and habitat change.

Introduction

Poimena Reserve is an urban reserve managed by the Glenorchy City Council and largely surrounded by housing. The total area of the reserve is around 29 hectares (Holderness-Roddam, 2012) but much of the area has been previously cleared and is now cleared or sparsely wooded. An uncleared bush area of about eight hectares occurs in the south of the reserve between Wakehurst Road and Mason Street and has been the focus of the surveying discussed in this paper.

The reserve was created in the early 1970s and its history, management and natural history have been well documented by Holderness-Roddam (2012). The reserve includes a low hill rising to 119 metres altitude on Jurassic dolerite. The main bush remnant section includes vegetation communities of degraded *Pomaderris apetala*/ *Asterotrichion discolor* low closed riparian forest, grassy *Eucalyptus globulus* forest and grassy *Eucalyptus viminalis* woodland. The reserve is especially noted for its diversity of jewel beetle (Buprestidae) records (eg Cowie, 2001).

Unsurprisingly, impacts on Poimena Reserve include the encroachment of housing on its boundaries, domestic mammals, weeds, exotic invertebrates, rubbish dumping, firewood collection and arson. Regarding the latter, "in the 1980s and 1990s the frequency was such that the nature of sections of the reserve were changed extensively" (Holderness-Roddam, 2012).

Methods

Land snails were surveyed in Poimena Reserve on 13 June 1990, 25 Jan 1991, 12 Dec and 15 Dec 2003, 12 Dec 2006 and 1 Aug 2017. The average duration of searching was around 90 minutes. The 1991 search was very brief (about 10 minutes targeting the most suitable habitat) but the remainder all exceeded one hour each. Suitable microhabitats were searched by hand including by turning rocks and logs and bark at the base of trees, and looking through lichen and moss on rocks, leaf litter and rubble at the base of overhangs. Surveys were conducted casually rather than pre-defined areas being surveyed each time.

The main focus of searching has been the wettest and least fire-impacted forest area in the reserve, with most searching conducted within about a 50 metre radius of 520125 E 5263280 S (GDA 94).

Table 1: Summary of native snail records from Poimena Reserve 1990-present.

	1990	1991	2003	2006	2017
Tasmaphena ruga					OD
Prolesophanta nelsonensis		D	D		L
Caryodes dufresnii	OD	OD	OD	OD	
Paralaoma cf hobarti	L	D	L	L	D
Gratilaoma sp "Knocklofty"	?	?	L	D	D
Trocholaoma parvissima				L	D
Punctidae sp "Micro Cripps"					D
"Planilaoma" sitiens				OD	
"Discocharopa" vigens			OD		
"Allocharopa" sp "Poimena"	L	L	D	D	D
"Allocharopa" sp "Christ College"	L				
"Allocharopa" sp "Wellington"	D				
Helicarion cuvieri	D				

L = live specimens seen, D = fresh dead specimens seen but no live specimens, OD = old dead specimens seen only.

Results

This section discusses the native species found and the nature of their records in the reserve in detail. The published formal taxonomy of Tasmanian native snails is currently outdated with around three-quarters of the fauna undescribed (author's unpublished research) and several of the many clearly incorrect generic allocations being revised by Stanisic *et al.* (in press). Pending publication of this and future works, some species are referred to comparable genus names in quotes although they are now known not to strictly belong to those genera.

Unreferenced statements about the occurrence of species outside Poimena are in all cases derived from the author's records.

While some of the other bush remnants around Hobart (eg Knocklofty and Queens Domain) have specific nineteenth-century land snail records, Poimena is not among those and there is no known information on what snails may have occurred there prior to the late 20th century.

The history of records for each native species from Poimena is provided in **Table 1.**

Family Rhytididae

Tasmaphena ruga (Legrand, 1871)

A very faded dead juvenile shell of this species was found in rubble under a small rock overhang during the 2017 survey. This species is fairly common alive in comparable forests in nearby larger reserves such as Knocklofty and Truganini Reserve (Mt Nelson-Taroona). (Plate 1).

Prolesophanta nelsonensis (Brazier, 1871)

This species tends to occur in small numbers where present. Single dead shells were found during the 1991 and both 2003 surveys. Two live and two dead specimens were found during the 2017 surveys.

Family Caryodidae

Caryodes dufresnii (Leach, 1815)

This common large Tasmanian snail appears to be locally extinct at Poimena Reserve. Only old bleached dead shells were found - a total of sixteen between the five earlier visits and none during the 2017 survey. Similar apparent local extinctions have been observed in bushland around Launceston (Taylor *et al.*, 1997) and also at a gully near the University of Tasmania Sandy Bay campus, but the species remains fairly common alive in Bicentennial Park (Mt Nelson-Sandy Bay) and Knocklofty. Where this species has apparently disappeared, clusters of whitened dead shells (primarily adults) are sometimes found under rock overhangs. Populations consisting solely of old adult specimens with very worn shells are fairly often found in disturbed areas, suggesting that the causes of local extinction may sometimes include predation by exotic pests on eggs.

Plate 1: Dry rubble in overhangs under dolerite boulders often produces old dead land snail shells. This image shows the area where an old dead shell of *Tasmaphena ruga* was found on the 2017 survey.

Family Punctidae

Paralaoma cf. *hobarti* (Cox, 1868)

Various Tasmanian punctids have been referred to the name *Paralaoma caputspinulae* (Reeve, 1851) but this name is inappropriate for Tasmanian material (Stanisic *et al*. in press). Determining how many native species there are and which are referrable to names that have been considered synonyms of *P. caputspinulae* is a very difficult task that is at this stage incomplete.

A species that may be referrable to the name *hobarti* is common in the Reserve and has been seen alive on most visits. No live specimens were seen during the 2017 survey but freshly dead specimens were found.

It is probable based on shell feature variation that more than one species is included in this material but this has not yet been confirmed.

Gratilaoma sp "Knocklofty"

This species, one of Tasmania's commonest undescribed snails, is very common in eastern and northern Tasmania, and occasionally recorded in the west. It has been recorded at least during all surveys since 2003, and was probably also found during the 1990 and 1991 surveys but at that time was not distinguished from the above.

Trocholaoma parvissima (Legrand, 1871)

This species occurs statewide but usually occurs in very small numbers. Two dead specimens were recorded in 1990, one live and one dead in 2006 and one dead in 2017.

Punctidae sp "Micro Cripps"

This tiny undescribed species occurs statewide. It resembles *T. parvissima* and has often been mistaken for it but is flatter with fewer whorls, a more open umbilicus, more prominent radial ribbing and an intensification of spiral sculpture around the umbilicus. Three dead specimens, one of them very fresh, were found in 2017, the first time the species had been found at Poimena. The species was not recognised as different from *T. parvissima* until about 2010, and since then I have found that it is often found by targeted searching in leaf litter in areas where I had not recorded it before.

Family Charopidae

"Planilaoma" sitiens (Legrand, 1871)

This species has been considered to be a synonym of *Paralaoma caputspinulae* but is a charopid based on having a tricuspid radula (Bonham, 2003). It superficially resembles *Planilaoma luckmanii* (Brazier, 1877) but requires reallocation to a new genus as its punctid-like protoconch sculpture is incompatible with *Planilaoma*.

The species has been found in many bush areas near Hobart. Where present it generally occurs in large numbers. However at Poimena only one degraded dead shell has been found, and that was found in 2006.

"***Discocharopa" vigens*** (Legrand, 1871)

This very rare species, soon to be reallocated to a new genus (Stanisic *et al.* in press) is listed as Endangered under the Tasmanian *Threatened Species Protection Act 1995* and Critically Endangered under the Australian *Environmental Protection and Biodiversity Conservation Act 1999*. It is apparently endemic to the greater Hobart area but has only been recorded alive in two precariously small colonies, and has not been seen alive since 2010. The record of a single old dead specimen at Poimena on 12 Dec 2003 was noted by Bonham (2004) and no further evidence of the species has been found there since.

"***Allocharopa***" sp "Poimena"

Species formerly allocated to *Allocharopa* (a synonym of *Elsothera*) will be reallocated to new genera by Stanisic *et al.* (in press). One of the new genera to be described includes a radiation of mostly undescribed Tasmanian species. At least thirty species in this group (which may include more than one genus) appear to be present in Tasmania but many forms are still being researched.

The species recorded here with the tag name "Poimena" occurs in the Hobart area on both sides of the Derwent River. It was originally included in the species below by Bonham (2003) but is smaller with a narrower umbilicus and usually a more elevated spire. It is probably at risk of extinction, although it is currently still common on the steep western slopes of Mt Direction.

During the 1990 survey, about 110 specimens of this species (about 20 alive) were seen under rocks, logs and leaf litter just in an area of about 20 by 20 m. near Roseneath Rivulet. This was the densest population of any member of this group the author has ever recorded. The species was also common in the 1991 survey, but following the burning of most of its habitat in the mid-1990s, only dead shells have been seen thereafter - twelve on 12 Dec 2013, five in 2016 and three in 2017. One of the 2017 specimens appeared reasonably fresh so it is possible a small population survives. (Plate 2).

"*Allocharopa*" sp "Christ College"

This is another localised undescribed species, present on both sides of the Derwent River and also north to at least Chauncy Vale (where it is locally common).

A small minority of specimens sampled from the 1990 trip were this species rather than the above, including one dead specimen found at the far eastern end of the bush remnant. It hasn't been seen in the reserve since.

"Allocharopa" sp "Wellington"

This species is common in wet forests throughout the Wellington Range and

Plate 2: A dense understorey of *Pomaderris apetala*, here shown next to a small walking track by Roseneath Rivulet. This closed-understorey habitat was once more widespread on the adjacent slope prior to fires in the 1990s.

the Cygnet peninsula. It is present in Truganini Reserve and in very small numbers at Bicentennial Park. A single freshly dead specimen was collected during the 1990 survey but the species has not been recorded from Poimena Reserve since.

Family Helicarionidae

Helicarion cuvieri Ferussac, 1821

Four dead shells of this common species were recorded during the 1990 survey. The species has not been recorded from Poimena Reserve since.

Exotic Snails and Slugs

No attempt has been made at a comprehensive survey of the exotic snail fauna of Poimena Reserve. However, at least the following have been observed within the bush remnant:

Oxychilus cellarius (Muller, 1774)

Oxychilus draparnaudi (Beck, 1835)

Candidula intersecta (Poiret, 1801)

Vitrina pellucida (Muller, 1774)

Deroceras reticulatum (Muller, 1774)

Lehmannia nyctelia (Bourguignat, 1865)

(In the past, *Candidula intersecta* has been recorded from Tasmania as *Microxeromagna lowei* (Potiez & Michaud, 1838) or its synonyms *M. armillata* (Lowe, 1852) and *Cernuella vestita* (Rambur, 1868). This was an identification error and all such records should be referred to *C. intersecta*.)

Discussion

Western shore Hobart bush remnants show variety in their diversity of recorded native land snail species based on the author's records since the mid-1980s. This especially applies to the family Charopidae. Examples are as follows:

- Truganini Reserve (Mt Nelson-Taroona) 21 species (7 charopids)
- Knocklofty 19 spp (8 charopids)
- Bicentennial Park 14 spp (3 charopids)
- Poimena Reserve 13 spp (5 charopids)
- University of Tasmania gullies 13 spp (2 charopids)
- Alum Cliffs 11 spp (2 charopids)
- Romilly Street - Pipeline Track remnant 10 spp (2 charopids)
- Hobart Rivulet reserve 8 spp (no charopids)
- Queens Domain 5 spp (no charopids)

The variation can be partly attributed to differences in the area and diversity of habitat in the remnants, and also to some of the remnants having more suitable habitat than the others and to more intense searching in some than others. The Queens Domain, for instance, lacks wet forest and probably always had less native land snail diversity than the others. However, the Hobart Rivulet Reserve remnant, a linear remnant that is around 1 km long by an average of 80 m. wide, contains a variety of degraded wet and damp eucalypt forest habitats and is highly likely to have originally supported many charopid species. Its recorded modern native fauna consists only of *Prolesophanta nelsonensis* and seven species of punctid.

Also, where charopid species do survive in the urban and near-urban bush remnants, they are often confined to a small core of the most intact areas that are furthest away from disturbance. Frequently predatory *Oxychilus* spp snails are absent or scarce in these core areas but common in the disturbed periphery that supports fewer native snails. *Oxychilus* predation has not been observed in the wild in Tasmania but it looks like being a major agent of charopid decline. Other exotic molluscs including predatory slugs, or unknown exotic non-mollusc predators may be contributing to charopid local extinctions.

In the case of the collapse of the Poimena charopid diversity, the time gaps between these surveys mean that it is hard to determine the cause(s) for the collapse. A large reduction in the area of habitat with an understorey of dense *Pomaderris apetala* was noticed from the 2003 visit onwards, as a result of fires in the previous decade. Some tall pine trees in this area had been felled in the late 1990s (Holderness-Roddam 2012) which may have opened up and dried out the understorey. Finally, there is always the risk of stochastic extinction for small populations in small remnants.

Of the 13 species recorded at Poimena, around half appear to have probably become locally extinct in modern times, either before the survey period (with only dead shells remaining) or during it. This is a far greater proportion than for the other listed reserves, none of which have had more than two such putative extinctions in modern times on the same basis.

Probably, Poimena is midway along a continuum with remnants with largely intact faunas at one end and remnants with long-depleted native faunas at the other. Thus at the Hobart Rivulet remnant, the absence of dead shells of *Caryodes, Tasmaphena* and whatever charopids may have been present is likely to be because those species became locally extinct there too long ago for shell evidence to remain. *Oxychilus* spp are often found around dry overhang environments where the oldest dead shells are often found, and would be likely to scrape away calcium from old shells thus hastening their disappearance from the landscape.

The picture for native snail populations in small urban remnants surrounded by impacts is not a promising one. Small-scale retained bush areas within new subdivisions are likely to be simply local extinction traps for native snails and other native ground invertebrates that are sensitive to similar pressures. This applies especially in the case of narrow linear reserves. Reserves that are larger and with a smaller percentage vulnerable to edge effects are likely to provide the best chance of keeping such faunas intact.

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A range extension for the freshwater crayfish *Geocharax tasmanicus* (Erichson), with notes on its conservation status and specific name

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Tasmania supports a diverse fauna of freshwater crayfish, forming, with SE mainland Australia, the world's second most important hotspot for freshwater crayfish diversity. Thirty four native Tasmanian species are currently recognised in 5 genera (*Astacopsis, Engaeus, Geocharax, Ombrastacoides* and *Spinastacoides*), plus one non-native species, the yabby *Cherax destructor*, which has been introduced to several parts of the State. All but three of the native species are endemic to Tasmania. *Engaeus cunicularius* and *E. laevis* are shared with southern Victoria, and *Geocharax tasmanicus* also extends into the Otway region of Victoria.

Figure 1. Rocky Cape National Park, showing the locations of new records of *Geocharax tasmanicus* at Rocky Cape and Sisters Beach (red dots) and location of possible habitat at Anniversary Bay. Inset: Entire range of *Geocharax tasmanicus*.

In Tasmania, *G. tasmanicus* is confined to lowland sites within a few kilometres of the coast in the far north west and King Island (Fig 1). It is usually found in flooded swamps and drains, but it can dig deep burrows, following the water table down when levels drop. The species has been little studied in Tasmania. Apart from a single Honours project dealing with activity rhythms (Ritchie 1978), only distributional records have been published, though some of these contributed to a major study of genetic diversity in the genus (Schultz *et al.* 2007). In the 1970s *G. tasmanicus* could be readily collected with a dip net in swamps and drains, but while collecting the material for the Schultz *et al.* (2007) study it quickly became clear that many of the older localities had been drained (eg Brickmakers Plain) or degraded (eg drains along the Bass Highway) and the species' area of occupancy had been greatly reduced. However, collecting for the 2007 study revealed a new population in a flooded swamp just south of the settlement at Rocky Cape, within the Rocky Cape National Park boundary (Fig 1).

Similar swamps occur elsewhere within Rocky Cape NP, for example on either side of Anniversary Point and seem to have formed where seaward drainage has been impeded by dune formations or on raised beach platforms. The most easterly of these lies just east of the Sisters Beach settlement, once again within the National Park boundary. On 30 Dec 2016 I used a dip net to sample pools in wheel ruts on a disused track behind the beach and collected (and then returned) two adult specimens (one male, one female) of *Geocharax tasmanicus*. This species is easily recognised among the Tasmanian crayfish by its almost black colour, smooth body and claws, and distinctive blade on the moveable finger of the claw (Plate 1). The available habitat seemed to be restricted to the old eroded track, but the very dense coastal heath made it difficult to assess the rest of the plain between the dunes and the hillside.

This record (Fig 1) extends the known range of *G. tasmanicus* about 9 km south east of Rocky Cape settlement and is almost certainly the eastern limit of the species' range since no similar coastal swamp occurs further east and there is no suitable lowland habitat further inland.

The presence of these two populations within Rocky Cape NP (and possible further ones around Anniversary Point) is encouraging, given the loss of inland habitat over the last few decades, but these areas of suitable habitat are small, and vulnerable to drying out under likely climate change scenarios (Grose *et al.* 2012). It may be appropriate to consider *Geocharax tasmanicus* for listing as a threatened species in Tasmania under the Tasmanian *Threatened Species Protection Act*.

Taxonomic Note

Geocharax tasmanicus (Erichson) was until recently known as *G. gracilis* Clark, but its name has changed for technical, but interesting, reasons that go back to the early European history of Tasmania.

Adolphus Schayer was manager of the Van Diemens Land Company's (VDL) estate at Woolnorth in north west Tasmania from 1835-1843 (Macfarlane 2010). During his tenure he collected natural history specimens which were sent to taxonomists in Europe and became type material for some of the earliest taxonomic descriptions of Tasmanian insects and crustaceans. One of these was the first Tasmanian freshwater crayfish to be described by a European. It was named "*Astacus tasmanicus*" in 1846 by Wilhelm Erichson, a German taxonomist who lodged the specimen in the Berlin Natural Science Museum, noting simply that it was collected in "Van Diemens Land".

Leaping over almost a century of taxonomic history we come to the work of Victorian biologist Ellen Clark who in 1936 established most of the freshwater crayfish genera that we use today. One of these was *Parastacoides* and Clark chose Erichson's *Astacus tasmanicus* as the type species for the genus on the basis of Erichson's brief description, but unfortunately she was not able to examine the actual specimen, even though she knew it was still in the Berlin Museum. Instead she used specimens collected from "Mt Lyell, near the type locality", ie the site where for some unknown reason she believed Schayer had collected the original specimen. Now it is highly unlikely that Schayer

Plate 1. *Geocharax tasmanicus*, from Sisters Beach, Tasmania. Note the dark, almost black, colour; smooth (glabrous) body and claws; large eyes and the straight, blade-like cutting edge on the movable, upper finger of the claw.

ever reached the Mt Lyell area in the late 1830s, given that it was unexplored by Europeans at that time. However Schayer's specimen now became the defining type for a genus of crayfish, ie *Parastacoides*, which is confined largely to the mountains, buttongrass plains and swamps of western Tasmania. In the same review Clark also raised another new genus, which she called *Geocharax*, containing two species, *G. gracilis* and *G. falcata* from far northwest Tasmania, and western Victoria and south east South Australia respectively.

In 1987, when it was becoming apparent that the Tasmanian crayfish fauna was much more diverse than earlier taxonomists had thought, I wrote, more in hope than expectation, to the curator of Crustacea at the Berlin Museum requesting a loan of the type specimen of *Parastacoides tasmanicus*. Edgar Riek, a taxonomist with the CSIRO, had described more *Parastacoides* species in the 1960s and remarked that Schayer's specimen had been lost (presumably a casualty of World War II), so I was pleasantly surprised when the specimen arrived in the mail. But the problems began when the specimen turned out to be not a *Parastacoides* species at all, but what Clark had described as *Geocharax gracilis*. In the VDL properties in NW Tasmania Schayer would very likely have encountered *Geocharax*, but Clark's failure to check the type specimen meant a) that *Parastacoides* was based on an incorrect and inappropriate type species, and b) that "*tasmanicus*" was an earlier species name for *Geocharax gracilis*. These matters are all decided by chronological precedent; what happened with *Parastacoides* is another story (see Hansen & Richardson 2006), but since Erichson had named that specimen "*tasmanicus*" long before Clark used "*gracilis*" the species of *Geocharax* that we have in Tasmania must now be known as *G. tasmanicus*.

Acknowledgements

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Caring for an Azure Kingfisher

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In March 2017 I had a call about an Azure Kingfisher (*Ceyx azureus*) that needed rehabilitation. It had flown into a window at Verona Sands and couldn't fly. Julie, the woman who found the "beautiful orange and blue bird" in her garden, phoned Bonorong for advice and it was taken to a vet in Kingston for an x-ray. As no bones were broken it went to Dave, a very experienced wildlife carer. Dave managed to stabilize the kingfisher and it was feeding well, but as he was looking after many birds at that time, he was glad to get it to another carer.

I could see that the bird was shy and very distressed by my presence which didn't help it rest. I have a good sized indoor observation pen so I created a bush-land setting with leaf litter, a large shallow pond and some low branches. Then I covered the cage with enough camouflage material so it could not see me as I approached. I found that I could quietly pass strips of meat and fish in on the end of a ruler and drop them on the side of the pond without upsetting the kingfisher. He also ate live crickets and bashed them up vigorously, so I knew the beak was not damaged. Dappled light allowed me to watch the bird feeding and hopping about, but it was too dark for great photos and difficult for anyone else to watch.

The kingfisher could fly about a foot off the ground but not gain height and after a few days I could see one wing was drooping a little, so I took it back to the vet for another x-ray. Thankfully this confirmed no break and by the end of the first week I saw improvement, so moved it to a pop-up tent with the same forest habitat and more overhead branches. The soft mesh sides of the tent would not injure the bird as it became more active. Again I had to cover the side so it could not see me placing the food and removing the water bowl for cleaning. The box of singing crickets kept him company until he had eaten them all.

I have been a wildlife carer for more than 30 years and cared for a wide variety of animals and birds as my experience and training has increased. A kingfisher in care is practically unheard of in Tasmania, and caring for it was a wonderful, but stressful experience.

My approach for caring for wild animals is to learn as much as possible about the species and provide for their needs, be very observant and ready for any change and not let them go too soon, or over keep them once they are ready to be released.

I often sat in a corner of the rehabilitation room and watched the kingfisher in the tent feeding and grooming. Although I had no idea of its sex I regarded it as a male. Gradually he flew to the highest perch and could drop directly down to the food and straight back up to the top perch to eat. I videoed it with my phone, texted it to the vet and got the OK to move the kingfisher to an outside aviary.

I needed to line the wire sides of the aviary completely with shade cloth, so there would be no damage to its feathers, beak or feet if the kingfisher touched the walls. The floor of the aviary is wired to keep out rats. I set up the same environment as I had inside and covered the door so he would not see me approach or replace the food and water. The kingfisher took advantage of the increased space and flew like a humming bird - hovering forward and back before landing on high and low branches. Now it needed to be disturbed a little to encourage exercise and build up its strength.

Three weeks after coming into care, I got the OK from the vet and the department that the kingfisher was ready for release. Thanks to Google maps, and some advice from bird experts, I chose Garden Island Creek as the nearest suitable kingfisher habitat to where it had been found. Verona Sands is densely populated with a tangle of houses, shacks, cars, dogs and cats. This was the first record of an Azure kingfisher at Verona Sands.

I was worried about catching the kingfisher in the aviary without injuring it. This is best done in the dark so it can't see you. I'm getting a bit old for balancing over a pond and branches in the dark, but I did eventually manage. Each time I had handled the bird, it screeched its piercing call. I was grateful for one last precious moment to hold this beautiful little bird and get a good peck from that amazing beak.

With the kingfisher safe in a travel pack, I drove to Garden Island Creek the next day and chose a secluded spot, not too far from the coast, but with dense overhanging vegetation. I had invited Julie from Verona Sands to come and share this special moment with me and we were joined by a nearby land owner too. When the door was opened the kingfisher flew out and up to a lichen covered branch from where it surveyed the area. This gave us the chance to snap a few parting photos and wish it well. My relief at seeing the bird back in the bush for its second chance at life was overwhelming.

To see a kingfisher is a very special thing. As a wildlife carer I have had many special experiences being close to native animals and birds. My time with this kingfisher is one I will never forget.

Azure kingfisher. Photograph: Els Wakefield

A note on the millipedes of Reid Street Reserve, West Ulverstone

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Reid Street Reserve (RSR) is a 2.6 ha bush block in West Ulverstone on Tasmania's North-West Coast. Formerly a private land parcel and a Crown quarry, its two contiguous parts were acquired by Ulverstone Council (now Central Coast Council) in 1987 and 1988. RSR is managed by Central Coast Council with the assistance of Friends of Reid Street Reserve. Management currently focuses on removal of shrubby weeds, mainly blackberry, bluebell creeper, cotoneaster, holly and Montpellier broom.

RSR lies on a hilltop and is surrounded by small residential and rural blocks (Plate 1). The Reserve has wide gravel tracks that were used in the past by local residents for recreational four-wheel driving and motorcycle riding. The lower part of the steep south-facing slope of RSR was quarried by the Public Works Department beginning in the 1950s.

Plate 1. Reid Street Reserve (yellow outline) and its surrounds in 2011. Aerial photo from www.theLIST.tas.gov.au ©State of Tasmania.

Despite this history of intensive use, RSR is a bush remnant in fairly good condition. There is no documented history of clearing, and tree cover today is greater than it was 70 years ago (Plate 2).

RSR carries mature *Eucalyptus amygdalina* and *E. viminalis* forest (Black Peppermint Coastal Forest) with a shrubby and sedgy understorey (Bushways Environmental Services 2011). The forest does not appear to have been frequently or intensely burned in recent decades, and litter invertebrate shelters (rotting logs, leaf and bark accumulations) are widespread in RSR.

I began millipede sampling in RSR in 2015. The species list currently comprises 13 native and two introduced species (Table 1), with the RSR natives representing more than half the native species recorded within a ca 10 km radius of Ulverstone. Millipedes are most abundant in leaf litter under *E. viminalis* on the south-facing slope of RSR.

Given the isolation of RSR from other native forest remnants in West Ulverstone, it seems unlikely that the Reserve will be colonised by "missing" native millipede species that may have been present there in pre-settlement times. However, the remarkably high present-day diversity seems likely to persist under current management. Millipedes will benefit from future treefalls (as large rotting logs for shelter)

Plate 2. Reid Street Reserve area in 1946 (left) and 2011 (right). The quarry at the southern end of the Reserve had not yet been opened in 1946. Aerial photos from www.theLIST.tas.gov.au ©State of Tasmania.

and from the continued establishment and growth on the south-facing slope of dense-canopied understorey shrubs, such as musk (*Olearia argophylla*).

Voucher specimens of RSR millipedes have been deposited in the Queen Victoria Museum and Art Gallery. Records of named native species in RSR can be found on the Millipedes of Australia website (Mesibov 2006-2017).

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Table 1. List of millipede species found in Reid Street Reserve, 2015-2017.

Order Chordeumatida
- Family Metopidiotrichidae
  - *Australeuma jeekeli* Golovatch, 1986
  - *Nesiothrix* sp. "castra" (undescribed)

Order Julida
- Family Julidae
  - *Ommatoiulus moreleti* (Lucas, 1860) (Portugese millipede; introduced)
  - *Ophyiulus targionii* Silvestri, 1898 (introduced)

Order Polydesmida
- Family Dalodesmidae
  - *Atrophotergum bonhami* Mesibov, 2004
  - *Gasterogramma psi* Jeekel, 1982
  - *Lissodesmus perporosus* Jeekel, 1984
  - *Tasmaniosoma fasciculum* Mesibov, 2010
  - *Tasmaniosoma hickmanorum* Mesibov, 2010
- Family Paradoxosomatidae
  - *Somethus tasmani* Jeekel, 2006

Order Polyzoniida
- Family Siphonotidae
  - siphonotid sp. "AcuMes" (undescribed)
  - siphonotid sp. "HetAus" (undescribed)
  - siphonotid sp. "SipIns" (undescribed)

Order Spirostreptida
- Family Cambalidae
  - cambalid sp. "central" (undescribed)
- Family Iulomorphidae
  - *Amastigogonus hellyeri* Mesibov, 2017

Two novel adult food plants for the green and gold stag beetle *Lamprima aurata* (Scarabaeoidea: Lucanidae) in Coastal Tasmania

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Introduction

The green and gold stag beetle *Lamprima aurata* is common and widespread in eastern and coastal Tasmania (Fearn, 1996). Because the annual emergence of this large and colourful beetle occurs around the festive season the Tasmanian public ubiquitously referring to it as the "Christmas beetle" although elsewhere in Australia this name is reserved for species of *Anoplognathus* (Rutelinae). *Lamprima aurata* is common in coastal and near coastal habitats in eastern Australia from southern South Australia to at least the Cape Tribulation area of north Queensland (C. Reid pers. comm., S. Fearn unpublished data). Six other morphologically similar members of the genus occur in Western Australia (*L. micardi*), New South Wales (*L. imberbis*), Lord Howe Island (*L. insularis*), Norfolk Island (*L. aenea*) and New Guinea (*L. adolphinae*). *Lamprima aurata* has the most extensive range through a wide variety of climate envelopes and thus habitats. This in part appears to have resulted in wide variations in colour and size. Morphological characters such as male body size and mandible length appear to represent a cline with such characters becoming increasingly larger towards the equator (S. Fearn, unpublished data). Extensive regional variation has led to many synonyms being erected over the years some of which are still in common use (e.g. *L. latreillii* for Queensland specimens). Hangay and De Keyzer (2017) provide a detailed overview of the taxonomic history of the *Lamprima* group.

Lamprima aurata displays a similar ecology across its range with larval development taking place in decomposing timber: typically subterranean root systems and stumps in cooler, drier portions of its range in the south and tablelands and increasingly logs and standing dead trees in the more humid portions of its range in the tropics (S. Fearn, unpublished data, Fearn, 1996). Adults display considerable trophic flexibility, feeding on a wide variety of native and introduced trees and shrubs as well as nectar-rich blossom and rarely, overripe fruit. The only *L. aurata* population for which larval and adult trophic ecology is well studied is the Tasmanian one (Fearn, 1996, 2015, 2016). The most common adult food source is the sap from shoots of trees and shrubs. Female *L. aurata* have small, apparently non-functional mandibles (in terms of trophic ecology) whereas the enlarged mandibles of males serve a twofold purpose: severing shoot tips to initiate sap flow and fighting other males to defend cut shoot tips and the attendant females attracted to them (Fearn, 1996, 2016). So far in Tasmania three smooth barked eucalypts are known adult host trees (*Eucalyptus viminalis*, *E. globulus*, *E. ovata*), also the coastal shrub *Ozothamnus turbinatus*, an ornamental Asian *Photinia* sp. tree an apricot tree *Prunus armeniaca* and the native grass *Lomandra longifolia* (Fearn, 1996, 2015, 2016).

Field Observations

On 07/01/2017 the author was conducting entomological field work in dune scrub land east of Greens Beach township, central north coastal Tasmania (GDA 94: 0479605mE 5452268mN). A male *L. aurata* was observed in flight, circling the crown of a mature coast wattle *Acacia sophorae* into which it alighted. In 40 years of observing *L. aurata* in the wild, the author had never seen this species feeding on any species

Plate 1. Mating pair of *Lamprima aurata* on *Clematis decipiens* at Greens Beach, Tasmania. Note severed shoot tip of vine.
Photograph: Simon Fearn.

of *Acacia*. Subsequent investigation revealed the beetle had landed on the stem of a native vine *Clematis decipiens* H. Eichler ex Jeanes (Ranunculaceae), growing up through the *A. sophorae* where several other males had gathered and were actively feeding on the vine in the usual way: by snipping off a terminal shoot with their mandibles. Further field work over the following two weeks revealed that both *C. decpiens* and *L. aurata* were common in the area. Many mating pairs of *L. aurata* were discovered feeding on severed terminal shoots of the host vine (Plate 1). All the specimens of *C. decipiens* examined by the author were growing up through mature stands of *A. sophorae* (Plate 2). Specimens of the vine were collected and lodged with the Tasmanian Herbarium and a series of *L. aurata* collected and lodged in the entomology collections of Queen Victoria Museum and Art Gallery (QVMAG)(Registration numbers QVM:2017:12:0605-0639).

On 22/01/2017 the author was conducting entomological field work in coastal woodland at the Bridport Wildflower Reserve, Adams Beach, Bridport, coastal north east Tasmania (GDA 94: 0532296mE 5463192mN). A large aggregation of *L. aurata* was observed on four saplings of drooping she-oak *Allocasuarina verticillata* (Lam.) L. A .S. Johnson (Casuarinaceae). All four saplings were approximately 4m in height and all were within 2m of each other. Approximately 50 *L. aurata* were actively feeding and copulating on the foliage of the *A. verticillata*. The majority of the beetles was on the lee

Plate 2. *Clematis decipiens* growing over mature *Acacia sophorae* in dune scrub land at Greens Beach, Tasmania.
Photograph: Simon Fearn.

Plate 3. Aggregation of *Lamprima aurata* on lee side of *Allocasuarinae verticillata* at Bridport, north east Tasmania. Photograph: Simon Fearn.

side of the easternmost tree (Plate 3) with the greatest wind protection. It was not possible to make an accurate count of the beetles present as additional specimens in flight were arriving throughout the observations. Males had severed individual terminal shoots with their mandibles and both sexes were observed lapping up sap from the cut ends. Mating pairs were at the terminal cut end of shoots and their combined weight had bowed the shoots down so that close observations and photographs could be easily taken (Plate 4.). Over the following week a series of single males that were unsuccessful in obtaining a mate were collected as voucher specimens and lodged in the entomology collection of QVMAG (Registration numbers QVM:2017:12: 0640-0676).

Discussion

Both *Clematis decipiens* and *Allocasuarina verticillata* are newly documented food plants for *L. aurata* and further illustrate the considerable flexibility of adult trophic ecology in this species (Fearn, 1996, 2015, 2016). It would appear that male *L. aurata* in particular are able to assess, locate and exploit a wide range of vegetation types with high sap/nutrient content. Given the wide range of food plants across several families that are known to be exploited, it is possible that preferences in any given region may vary from year to year depending on individual plant conditions due to climatic variables such as rainfall and temperature. The late B. P. Moore (in Hangay and De Keyzer, 2017) suggests that varying levels of methyl salicylate in native foliage may act as an attractant to concentrate *Lamprima* beetles. The situation in Tasmania would tend to indicate that there is a wide range of as yet undocumented adult food plants throughout the extensive mainland range of *L. aurata*, particularly in the botanically speciose tropics. In both examples recorded in this work, it was only males that were observed to cut shoot tips and provide the sap food source so eagerly sought after by females. Males were observed engaged in identical combat and mate guarding behaviours as previously documented for Tasmanian specimens (Fearn, 1996, 2015, 2016).

Plate 4. Mating pair of *Lamprima aurata* on *Allocasuarinae verticillata* at Bridport, north east Tasmania. Note female feeding on sap exuding from shoot tip severed by male. Photograph: Simon Fearn.

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Ticket to Ride: A Natural History from Bus 448

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Bus number 448 sits at its starting point in Hobart, purring, awaiting with door open to take passengers on a magical, mystery tour. Slightly battered and worn, its green and cream livery showing Metro wear and tear, the bus and the route it takes is an unlikely metaphor for that place where the natural and the human worlds meet.

The bus on route 448 climbs out of Hobart hourly, winding its way south-west to the base of kunanyi/Mount Wellington. It follows the contours of the mountain's foothills and at the same time traverses its ecological and climatic zones. The chugging, throbbing of diesel engine, the caw of raven; mankind and nature come together in time and place.

The time is 10.20am and the place is Franklin Square, at the start of the 27-minute journey to Fern Tree, last reach of the human tentacles of suburbia before Mother Nature takes over.

In that short space of time, however, and over a distance covering a mere 13 kilometres all will be revealed. The stark outline of the Metro map, inking the 448 route in red, cannot possibly reveal what is in store for the observant and curious bus passenger. Birds and botany rule on route 448. And geology.

The bus will climb through and across the strata of rock underpinning the city and the mountain.

As soon as the folding doors of the bus snap shut, the passengers prepare for their adventure in both human and natural history. Franklin Square is just across the street from the site of the first basic settlement of Hobart, a sea of army tents on the north side of a dirt track that would become Macquarie Street. The white and blue gums, the peppermints and silver wattles have long gone – along with Swift Parrots – but other previous inhabitants remain among the exotic oaks and elms.

In winter, Yellow-tailed Black-Cockatoos prise open the fissures in the bark of the European trees in a search for wood-boring insects, and Forest Ravens and Silver Gulls look for pickings among the debris and detritus left after office workers have gathered in the park for lunch. And with luck, a Peregrine Falcon might fly overhead, leaving a roost on a city high-rise building for a hunting ground over the Derwent, or on the mountain.

A mountain-bound peregrine, and for that matter a black cockatoo, will follow the route of the 448, pushing south-west on the climb along Davey Street before negotiating the southern side of the valley cut by the Hobart Rivulet, past Turnip Fields and squeezing through a gap in the hills framed by Knocklofty to the north.

The remnant blue gums in the grounds of the Anglesea Barracks (which still attract Swift Parrots in spring) along Davey Street and the exotic vegetation of the gardens of South Hobart retreat as rapidly as the brick and glass of suburbia. And birds that make the suburbs their home like New Holland honeyeaters and Little Wattlebirds fall silent as the birds of wilder country, and the mountain, take over. Grey Currawongs chant as the 448 continues its journey, past the old bus turning circle at the start of the Huon Road which was once the end of a shorter route.

This is country the first Tasmanians, the Mouheneenner people, and first settlers knew. Viewed from the windows of the bus, it has changed little since. The gum species indicate different soils, and difference in temperature and rainfall and the birds do the same to mark out wet and dry sclerophyll, Pink Robin for wet country, Dusky Robin for dry.

Rock and soil making up the geologic foundations of the mountain are revealed by the peppermints, three species as obvious as the strata of differing rock.

On the upper side of the Huon Road, just past bus stop 19, black peppermints form

Plate 1: Silver peppermint woodland. Photograph: Mick Brown

a canopy of narrow, finger-like leaves. The black peppermints grow on sandstone, and at the roadside sedimentary rock glows golden. Unlike other eucalypts, the bark is not flaky in colours of yellow and orange, but rough and rutted and dark. It holds the colour and texture of an elephant's hide. Yellow Wattlebirds, endemic to Tasmania, frolic in its branches.

Nature lovers might merely take the 448 to gain access to the mountain and, indeed, it sounds eccentric to view the bus as an end in itself, but my own interest in natural history does not draw lines between the urban, peri-urban and suburban. I watch nature at work wherever and whenever I can find it.

I was heartened to discover when I came to live in Hobart that a group of residents of South Hobart also recognised the value of an environment shaped by suburbia. And a publication they produced, *South Hobart's Bushland Booklet*, plugged neatly into my philosophy. It used the bus route as a guide, even giving the specific bus stop, the 19, where a tree of interest could be seen. The booklet, written by the Huon Road and Jubilee Road Bushcare Groups, is the inspiration for my Route 448 Wildlife Tour. The bus trip really is magical, and mystical if the imagination is allowed to penetrate the foliage seen from the roadside and dwell on what lies within if not actually seen from the Scania bus itself.

The foothills feature sedimentary sandstones and mudstones laid down during the Permian Period (230-280 million years ago). Further towards the mountain these are overlaid by sandstones rich in quartz formed during the Triassic (180-230 million years ago). Finally, molten igneous rock from the Jurassic Period 170 million years ago tops the summit, the dolerite Organ Pipes the standout feature all along route 448.

After the black peppermint, the next stop introduces silver peppermint (Plate 1). These eucalypts favour a foundation of mudstone and you can see the fragile rock, crumbling and soft, like an apple crumble desert, at the roadside edge. Yellow-throated Honeyeaters, another endemic species, flit through bough and branches holding thin and shiny tin-foil leaves. The yellow bark is heavily streaked in maroon.

Then white peppermints, more restrained than their silver cousins with muted yellow bark and blue-green leaves, where the Huon Road forms a junction with the lane to Chimney Pot Hill. A granite, pillbox bus shelter – dotted with ivory-coloured lichen – marks the stop on the other side of the road.

The white peppermints to the east are a distraction. The 448 route has left dry woodland and an under-storey of golden rosemary and entered clinging forest of wet sclerophyll. The road twists and turns and then the bus turns back on itself on the u-bend where it crosses the upper reaches of the Sandy Bay Rivulet.

Stringybarks arch over the road, and the straggly, untidy leaves of blanket-leaf form an understorey, laying claim to the thin grass verge.

In spring the blanket-leaf has clusters of pale yellow flowers. As summer arrives, Christmas bush dots the tight green coat of lush vegetation with buttons of white flowers.

And the birds have changed. Although Tasmanian woodland and forest species can generally be found in both wet and dry forest, some do have preferences.

With windows open on the bus, the passenger might just hear the distinctive "wop, wop" at the end of a loud, far-carrying song that distinguishes the endemic Tasmanian Thornbill from the Brown Thornbill (Plate 2), also found on the mainland. The Tasmanian species prefers higher, wetter ground than a cousin more at home in drier country.

Above the Sandy Bay Rivulet bridge, the signature tune of the Tasmanian high country rings out. The trumpet song of the Black Currawong replaces the "clinking" call of Grey Currawong of the drier areas closer to Hobart. Not surprisingly the Grey Currawong is also called the "clinking currawong" in Tasmania. The Black Currawong sometimes goes by the name of mountain currawong, or black jay.

The wet forest is merely an introduction to the rainforest to be discovered beyond the bus's destination at Fern Tree.

Although true rainforest is usually associated with Tasmania's wild west, a not so hard climb will take the passenger liberated from the confines of the bus to high-rainfall species like myrtle and sassafras along the Pipeline Track going south, or to strands of the tallest flowering plant on the planet, swamp gums, along trails leading to the Shoobridge Track going north.

The outward bus journey has offered spectacular views of the mountain, especially if it has been undertaken in morning sunshine when the mountain's dolerite Organ Pipes are dissected in light and shade by a rising sun. The return journey is equally spectacular, as the bus follows the contours of the mountain's foothills and glides towards the River Derwent, as if carving its own route in competition with the Sandy Bay and Hobart Rivulets to the north and south of it. The contoured route sticks to higher terrain.

Although migrating birds, and to a degree mammals moving from one location to another, might follow the course of the rivulets, some bird species can be seen from the 448 bus taking the same route.

Twice a year, in spring and then autumn, the Crescent Honeyeaters and Eastern Spinebills move between breeding grounds on kunanyi/Mount Wellington's higher slopes to a winter range nearer the coast.

On the drier slopes in spring spinebills can be seen dashing between the pendulous bell flowers of common heath on the sandy embankments just north of South Hobart. Crescent Honeyeaters feed a little higher, in the canopies of the peppermints.

In autumn, the direction is reversed, as surely as the return journey of the bus. The spinebills and honeyeaters descend together, their calls in duet. The harsh, staccato of the honeyeaters as they make their "eg-ypt, eg-ypt" contact call melds with the high-paced, descending twitter of the spinebills.

Journey's end, not at Franklin Square but on Macquarie Street and a welcome from domestic pigeons and starlings. Back to reality, the sharp end of man's intrusion into the natural world. Mother Nature hangs in and hangs on, however. Just over the road in Franklin Square a Green Rosella sails forth, and another bus on the 448 route is about to depart.

Plate 2: Brown Thornbill above, Tasmanian Thornbill below.

Photographs: Mick Brown

Notes on a sighting of breeding Spotless Crakes and incidental observations at Blue Lagoon, Dodges Ferry

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Introduction

My first sighting of a Spotless Crake in Tasmania was on 25 February 2017 during the South East wader count for Birdlife Tasmania. Mona Loofs-Samorzewski and I stopped at Blue Lagoon, a small wetland behind the dunes at Dodges Ferry. Even though I had observed and photographed a Spotless Crake once before at the Werribee sewage farm in Victoria, I had never seen one in Tasmania. This was despite a few reports at Goulds Lagoon and the Tamar Wetlands in the last few years.

Plate 1. Spotless Crake with chicks at Blue Lagoon near Dodges Ferry. Photograph: Mona Loofs-Samorzewski.

Observations

Our cautious approach to the lagoon allowed a fleeting glimpse of a Spotless Crake rushing off into the surrounding vegetation. We stopped and waited quietly before making a further approach and were rewarded by good views of an adult feeding two fluffy little chicks. (Plate 1). The chicks kept close to the reeds, often diving almost out of sight as the adult foraged for food, occasionally enticing the chicks forward to be fed. It was a wonderful thrill to watch them and as the sun was shining on the area, we both managed to obtain some good photographs of the birds. Mona had the best ones of the chicks in full focus out in the open.

On 28 February I had a chance to return to Blue Lagoon. I found a spot beside the original place where we had seen the birds and stood with the sun behind me for some hours. Although the adult birds were still present, the chicks did not make an appearance and I wondered if they had been taken by a raptor. It was not until my next visit on 1 March that I was again rewarded with a sighting of the chicks. They were slightly less fluffy and seemed to have grown. Both came out into the open and dashed through the water between two tussocks, coming into full view. They seemed to have a small white saddle at the base of the bill. I was fascinated by the dark blue-green plumage on the head and neck and on the rump of the birds. There were two green stripes that radiated from the base of the bill and over the crown above each eye to the nape. There was another patch of the same colour on the rump, extending down to the tail. The description of downy young in Marchant and Higgins (1990) reads: "When newly hatched, evenly covered by black down, which has greenish sheen when sunlit. Replacement of down begins first on breast and thighs at 15 days; down remains longest on head and does not fade before it is shed."

Plate 2. Juvenile Spotless Crake 8th. March 2017. Photograph: Els Wakefield)

Standing beside the lagoon on the mossy edge, it was difficult to obtain a clear view of the birds through the surrounding grasses and reeds. While waiting for sometimes many hours for them to appear, I enjoyed observing the other wildlife around the lagoon. A tiny Brown Tree-frog was sitting on top of a cumbungi flower head and did not move as I arrived. Others hopped across the dew laden moss at my feet and slowly climbed up the grass stems. A young Banjo Frog scrambled over the moss, its brown patterns camouflaging it beautifully in the undergrowth. On the lagoon there were good numbers of young Eurasian Coot of all ages, some being fed by the parents, others large enough to be feeding independently. I had never seen such a large group of coot breeding in Tasmania where they are often difficult to find with chicks. Also with young were Pacific Black Duck, Black Swan and Tasmanian Native Hen. Grey Teal and Chestnut Teal kept a wary eye on me where I stood. In the pine trees above me there were Yellow-tailed Black Cockatoos feeding on the green cones and dropping them to the ground nearby. Green and Eastern Rosellas, Noisy Miners, Little Wattlebirds, Forest Ravens and a Grey Butcherbird came quite close. Large groups of Rainbow Lorikeets and Musk Lorikeets flew past overhead. A few White-faced Herons and a Little Pied Cormorant roosted on a fallen, dead tree nearby.

Over a period of a few weeks I made regular visits to Blue Lagoon, photographing the adult Spotless Crakes and the chicks as they grew and became more active, venturing further from the reeds. (Plate 2). I photographed the adults flying, running through the water and into the rushes up a small ramp of bent over leaves to join the chicks hidden within the vegetation. Other birders sometimes joined me to wait and watch patiently, usually rewarded with good views of the crakes.

Eventually, however the crakes did not appear and I wondered if they had ventured further afield to forage in other more hidden areas around the lagoon.

On 3 April I arrived to find a group of Tasmanian Conservation Volunteers clearing the invasive cumbungi plants from around the lagoon so I decided it would be unlikely to see the birds and I left after a few words with one of the participants, Keelan Spotswood and the organiser, Carly Lambert.

On 8 April I was invited to join the local Coastcare group for a very educational Frog Day at Blue Lagoon. The excited children found a Spotted Marsh Frog as well as the Brown Tree Frog and Banjo Frog in the surrounding marsh. Carly and Keelan were there too and Keelan approached me excitedly to tell me that he had sighted a Spotless Crake while they had been clearing the cumbungi. They also told me they had located what they thought were two Spotless Crake nests, one with some feathers and egg shells inside it. They led me to the nests which were tall and made of loosely woven grasses and vegetation with a cupped area on top. One nest seemed to be falling apart. The other was tighter and this one still had a few feathers on top and fragments of shell that had fallen down into the centre of the nest. Spotless Crakes are semi-precocial which means they leave the nest within 24 to 48 hours after coming out of the shell. The fact that shells were still in the nest suggests it belonged to Spotless Crakes as adults of other birds usually remove the shells after the chicks have hatched. I collected the fragments and took them home to consult Marchant and Higgins (1990). The description of the eggs read: "close-grained, smooth, slightly lustrous; dull creamy-brown with numerous distinct flecked markings of light chestnut-brown, uniformly distributed over shell, or with few irregular spots and streaks of darker hue, chiefly on one end where a small cap is sometimes formed" (p.564). As there were no whole eggs, it was difficult to see if the fragments were from one or more eggs but the colours seemed to match the description. The shell fragments are white with minute dark bown spots varying slightly in size evenly distributed over the pieces. Slater *et al.* (2009) describe the eggs as "4-6 mottled umber eggs" (p. 92).

As the removal of the cumbungi had so severely disturbed the area around the two nests as well as where I had observed and photographed the crakes, I ventured to carefully approach the area behind the two ramps that led from the reeds down to the water. I had hoped to see a nest inside the vegetation but could not find anything apart from trampled and guano covered vegetation where the chicks had been hiding. I suspect they had come away from the nest site to this area to hide and feed, using the ramps for access to their hiding place.

During the whole time, I never heard the Crakes calling and suspect this was to avoid drawing attention to the chicks.

Returning to an area to do careful and long-term observations is one of the most rewarding and enjoyable experiences for me. The Spotless Crakes at Blue Lagoon brought me into contact with other local birders and conservationists and has hopefully inspired others to just stand and observe.

Acknowledgement

Thanks to Mona Loofs-Samorzewski for her photograph.

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A translocated population of the mainland Australian Cockroach *Drymaplaneta semivitta* Walker, 1868 (Blattidae: Polyzosteriinae) in Launceston, Tasmania

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Introduction

Amongst the global environmental challenges of the 21st century is the geographic rearrangement of the world's biota and the consequences arising from it (Simberloff & Rejmanek, 2011). Many translocated or introduced species can seriously affect agriculture, forestry, fisheries, ecosystem function, human amenity, as well as animal and plant health. Such impacts are often more pronounced in island ecosystems and in Australia alone >3500 invertebrates (terrestrial and marine), vertebrates and plants have become established through anthropogenic action since European contact (Low, 2011). Invertebrates are among the most successful invaders as they are often small and hence easily overlooked, fast reproducing and short lived (*r*-selected) as well as having a suite of ecological and behavioural adaptations (e.g. resistant dormant stages) that readily facilitate unwitting anthropogenic transport (Bufford & Daehler, 2011).

Blattodeans (cockroaches) are notorious invaders, but only a relatively small number of the world's approximately 4500 species have cosmopolitan distributions due to unintended anthropogenic transport (Rentz, 2014). The most important economic species are in the Families Blattinae (*Periplaneta* and *Blatta* spp.) and Ectobiidae (*Blattella*) and all are closely linked in biology to anthropogenic habitats. These species are detrimental to human health through release of allergenic chemicals into the air in dwellings, spreading a wide range of medically important pathogens, spreading food-borne parasites as well as spoiling human food with up to 13 species of fungi (Evangelista *et. al.* 2013). Nine of these cockroach species (*Periplaneta australasiae*, *P. fuliginosa*, *P. brunnea*, *P. americana*, *Blatta orientalis*, *Neostylopyga rhombifolia*, *Blattella germanica* and *Supella longipalpa*) are well established over much of Australia but are largely confined to urban habitats (Rentz, 2014). Many of the above species are intercepted on a regular basis in a wide variety of goods entering Tasmania (L. Hill, Biosecurity Tasmania pers. comm.) but only *Blatta orientalis* (oriental cockroach) and *Blattella germanica* (German cockroach) are established in some urban centres. It is very likely that Tasmania's cool climate has prevented the establishment of the large and essentially tropical *Periplaneta* spp. Australian mainland native cockroaches of little or no economic consequence are also detected at biosecurity barriers as well as being delivered to the Queen Victoria Museum and Art Gallery (QVMAG) by members of the public who find specimens in their homes and places of work.

One such genus is *Drymaplaneta* (wood runners) which comprises six named species, the majority of which occur naturally in Western Australia (*D. lobipennes*, *D. heydeniana*, *D. semivitta*, *D. shelfordi* and *D. variegata*). *Drymaplaneta communis* is widespread in south eastern Australia (Rentz, 2014). Populations of *D. semivitta* (Plates 1 and 2) in Victoria and the ACT are presumably unintended translocations (ALA-bie.ala.org.au/.../urn:lsid:biodiversity.org.au:afd.taxon:4084ab92-7a98-420a-a1da-fb; S. Fearn unpublished data) and this species has been established in New Zealand for many years (Somerfield, 1977). Apart from *D. shelfordi* which has a uniform black colouration, the other members of the genus are all superficially similar 'two toned' blattodeans of reddish to very dark brown body colours with distinctive white to yellowish bands around the outer edge of the body (Rentz 2014; Plate 1). Only *D. communis* and *D. semivitta* are known to overlap in distribution in eastern Australia and while both are a similar size (18- 30mm), the latter displays notably thickened hind tibiae in males (Plate 2). Live specimens of *Drymaplaneta* have been detected entering Tasmania (L. Hill, Biosecurity Tasmania pers. comm.) and specimens of *D. communis* have been delivered to QVMAG for identification by members of the public.

There is only one native and apparently endemic Tasmanian cockroach that could be confused with *D. semivitta*. *Temnelytra* sp. nov. was identified as an undescribed species by Australia's leading cockroach taxonomist Dr David Rentz from specimens collected in the senior author's suburban yard in Riverside, Launceston and held in the collections of QVMAG (Plate 3). This species is also a 'two toned' blattodean up to 20mm in length but is more colourful, typically orange/red with cream/yellow borders extending the whole length of the insect as well as being more gracile in overall shape. Rentz (2014) provides keys to the genera of Australian cockroaches.

In this work we report what appears to be an established, translocated population of the mainland cockroach *Drymaplaneta semivitta* in central Launceston.

Plate 1. Adult female *Drymaplaneta semivitta* (QVM:2017:12:1454) from Alice Place, Launceston, Tasmania. Note distinctive white/cream edging. Photograph: S. Fearn.

Plate 2. Adult male *Drymaplaneta semivitta* from Canberra, ACT (QVM:2017:12:1436). Note expanded central portion of hind tibia. Photograph: D. Maynard.

Plate 3. *Temnelytra* sp. nov. Riverside, Launceston, Tasmania. Photograph: D. Maynard.

Field observations

In February 2017 the second author collected a large female cockroach with a fully formed ootheca protruding from the abdomen at her residence in Alice Place, central Launceston and gave it to the senior author for identification. Having previously encountered *Drymaplaneta* species on the mainland the senior author recognised the genus immediately. Consultation of Rentz (2014) and examination of specimens held in the QVMAG entomology collection confirmed the specimen conformed to *Drymaplaneta*. Since the collection of the initial specimen (QVM: 2017:12:1452), two further specimens from the Alice Place residence (QVM: 2017:12:1453-1454) were added to the collection in March and May 2017. Specimen 1453 was collected from a trampoline moved from the yard of a neighbouring residence. When initially moved, approximately six specimens of *D. semivitta* were disturbed from their shelter under the plastic covering on the outer steel ring of the trampoline surface. Not being aware of the significance of the cockroaches, the owners of the trampoline did not collect any at the time. In addition to the specimens collected from the second author's residence other specimens have been observed sheltering under welding gloves in a shed. The very first *Drymaplaneta* specimen observed at the second author's residence was *ca*. 2005 and was an adult female with attached ootheca, concealed among papers in a folder left on the floor. It is possible therefore that *D. semivitta* has been established in the area for at least 12 years.

All the Launceston *Drymaplaneta* specimens available for examination up to June 2017 were female so the authors were not confident in assigning a species to them. That was until June 17, 2017 when another QVMAG staff member photographed a large cockroach on an external door at her residence in Eardley St, South Launceston, 1.1km from the location of the original specimens in Alice Place (C. Todd, pers. comm.) The photo appeared to be an adult male *D. semivitta* as indicated by its prominent expanded hind tibia. Two days later three more adult *Drymaplaneta* were collected at the Alice Place property (QVM: 2017:12:1455-1457) including two males which also conformed to *D. semivitta*. On the evening of 19 June 2017 an adult female specimen of *D. semivitta* was secured at the Eardley St residence under a plant pot on a wooden deck and delivered to the senior author (QVM:2017:12: 1458).

Discussion

The translocation and establishment of both exotic and mainland Australian blattodeans to Tasmania is inevitable given the many invasion pathways open to these invertebrates. Modern human transport technology as well as the rapid increase in human travel and trade across perceived barriers such as oceans is increasingly facilitating the spread of organisms (McDowell 2011; Rentz 2014.). Blattodeans, in particular, are well suited to surviving relatively long periods in transit (especially in the oothecal stage) and avoiding detection. Many blattodeans, especially those in genera with an invasion history, display considerable behavioural and trophic flexibility which may make subsequent survival and colonisation more likely in novel habitats (Rentz 2014; McDowell 2011). *Drymaplaneta* species may be emerging as one such example. Both *D. communis* and *D. semivitta* are commensal, sometimes becoming a minor nuisance in homes, and they can be present in high densities in urban habitats (Rentz 2014; S. Fearn unpublished data). At one residence in urban Canberra, *D. semivitta* had never been observed in a house but was common nocturnally in the garden and house exterior. Large congregations of adults and nymphs were observed among large sheets of cardboard packing leaning against an external wall as well as in a recycling bin full of cardboard and paper. Other specimens were observed on well weathered paling fences (S. Fearn unpublished data). The trophic ecology of this species apparently includes wood fibre and an association with paper and cardboard which would facilitate unwitting translocation in all manner of freight as well as enhancing survival prospects in transit. The size and range of the *D. semivitta* population in Launceston is unknown but it appears to have left the incipient stage to become established and reproductive. Once established, even if in a relatively confined geographical area, *Drymaplaneta* could be expected to have a very high likelihood of both relatively long and short-distance dispersal mechanisms (stratified dispersal) within Tasmania through the movement of people and their belongings and goods. During the editing of this paper a female specimen of *D. semivitta* was confirmed from Sandy Bay, Hobart after it was delivered to TMAG (S. Grove pers. comm. 26 June, 2017).

The cockroach fauna of Tasmania is virtually unknown. For example, three entirely new and currently unnamed species (*Temnelytra*, *Ellipsidion* and *Balta*) have been identified from the senior author's suburban garden in Launceston. At least five other apparently undescribed species in three genera have been collected by QVMAG in various Tasmanian habitats over the last three years. However, there would appear to be little doubt that *D. semivitta* is a recent introduction as it is a large and conspicuous commensal species with no collection history in the state. All previous known specimens are singletons arising from border inspections or specimens brought in to QVMAG by members of the public associated with freight (L. Hill, Biosecurity Tasmania pers. comm. S. Fearn, unpublished data). The Tasmanian Museum and Art Gallery (TMAG) had no specimens of *Drymaplaneta* prior to 2017 (S. Grove pers. comm.). With the rapid rise of global travel and trade, coupled with a steady decline in entomological expertise, new species will arrive and remain undetected until the opportunity for control has passed (Rentz, 2014). We urge all interested Tasmanians to be alert to the possibility of novel species and to collect specimens and take them to either of the state's museums or to Biosecurity Tasmania.

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Ghost fungus *Omphalotus nidiformis* (Berk.) O.K.Mill (Marasmiaceae) as a host for the fungus Beetle *Thallis compta* Erichson, 1842 (Coleoptera: Erotylidae) In Northern Tasmania

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Introduction

More than 1500 species of the predominately tropical beetle family Erotylidae (fungus beetles) are known globally, with about 120 known from Australia (Lawrence and Slipinski 2013). Australian Erotylidae are mycophagus as larvae (as well as adults in some species,) feeding within the fruiting bodies of both Agaricales and Aphyllophorales (mushrooms and bracket fungi; Hawkeswood, 1986; Hawkeswood *et al*. 1997; Lawrence & Britton 1991; Lawrence & Slipinski 2013). The biology and habits of the 17 named species of *Thallis* in Australia are poorly known. Hawkeswood (2003) recorded three adults of *T. erichsoni* were collected on the underside of the fruiting body of *Pseudotrametes* (*Trametes*) *gibbosa* (Polyporaceae) in south east Queensland but did not document feeding or oviposition. Webb and Simpson (1991) recorded a single adult *T. australasiae* on *Polyporus mylittae*, large aggregations of adult *T. janthina* on *Piptoporus portentosus* as well as aggregations of *T. vinula* on *Polyporus squamosus*: all in New South Wales. In Tasmania, Bashford (2014) reared *T. femoralis* from the bracket fungi *Phellinus whalbergii* and *Ryvardenia cretacea* as well as *T. vinula* and *T. janthina*- also from *R. cretacea.*

Thallis compta is an aposematically coloured black and orange erotylid beetle ranging from 5-7 mm in length (Plate 1) and is widespread in south east Australia (Atlas of Living Australia; Moore 1990) as well as the drier eastern half of Tasmania (author, unpublished data; Bashford 2014) where it commonly flies to light traps in the summer months (authors obs.). The orange/red and black colouration of many members of the genus is

Plate 1. Adult *Thallis compta* on fruiting body of *Omphalotus nidiformis* at Riverside, Launceston, Tasmania. Photograph: Simon Fearn.

thought to provide crypsis on bracket fungi and large Agaricale fruiting bodies (Hawkeswood *et al.* 1997). The only previously documented potential host for *T. compta* was a single adult associated with hyphae of *Polyporus* sp. in NSW (Hawkeswood *et al.* 1997).

Omphalotus nidiformis (ghost fungus or jack-o-lantern mushroom) is most notable for its bioluminescent properties. It is known to occur primarily in southern Australia but was also reported from India in 2012. It is the only member of the genus known from Tasmania. The fan- or funnel-shaped fruit bodies are up to 200-300 mm in diameter and usually found at the base of dead trees and stumps. Fruiting bodies are often found in overlapping clusters and are cream-coloured caps overlain with shades of orange, brown, purple, or bluish-black. The white or cream gills run down the length of the stipe, which is up to 80 mm long and 20 mm wide and tapers in thickness to the base (Grey & Grey 2005; Gates & Ratkowsky 2016). Typical specimens are featured in Plate 2.

This paper documents the first record of *Omphalotus nidiformis* as a larval host of *Thallis compta*.

Field Observations

On 4 November 2016 the author was conducting entomological field work in open woodland dominated by white gum (*Eucalyptus viminalis*) and black wattle (*Acacia mearnsii*) at Ecclestone Road, Riverside, Launceston, Tasmania (GDA 94: 0502334mE 5414255mN). On a portion of partially cleared land the author located five tree stumps (1 unidentified eucalypt and 4 *Acacia mearnsii*) ranging from 200-400 mm diameter within an area of approximately 20 m diameter. Large, recently emerged fruiting bodies of ghost fungus (*Omphalotus nidiformis*) were observed emerging from the base of the stumps (Plate 2). On closer inspection, large numbers of the fungus beetle *Thallis compta* were observed milling around on the fruiting bodies (Plate 1). It was a warm sunny mid-morning and the beetles were very active, with numerous pairs copulating and what appeared to be the larger males actively chasing each other away from portions of the fruiting bodies. It appeared that more than about 100 beetles were active across the five major clumps of fruiting body. Photographs were taken and 28 voucher specimens of *T. compta* collected and lodged in the entomology collection of the Queen Victoria Museum and Art Gallery (QVMAG; registration numbers QVM.2017.12.1116-1143).

Housing of infested fruiting bodies

On 18 November 2016 the author returned to the site to collect the fruiting bodies in an attempt to rear out adult *T. compta* thus confirming *O. nidiformis* as a larval host. The fruiting bodies were greatly reduced in size due to obvious desiccation. Four of the largest clumps were removed from the stumps with a hatchet as they were firmly adhered to the decomposing timber just below ground level. The fruiting bodies were placed in cardboard postal boxes approx. 240 x 180 x 80 mm and placed in a larger plastic crisper with air holes drilled in it and placed on a shelf in a shed. When the fruiting bodies were inspected on 3 December 2016 the postal boxes were filled with large quantities of frass and what appeared to be fine silk. Hundreds of pre-pupal larvae were present under the silk and frass. The author mistakenly anticipated that pupation would occur within the fruiting bodies with the adult beetles eventually emerging from them as reported by Bashford (2014) when rearing Erotylidae from fruiting bodies of bracket fungi. It now appears that the final instar larvae of *T. compta* in mushrooms decamp from the rapidly deteriorating fruiting bodies and most likely pupate in the surrounding soil. Although not ideal conditions, the author periodically kept the boxes humid with a small ‘mister bottle’ and the first adult beetles began to emerge in March 2017. Some of these were also lodged in the QVMAG collection (registration numbers QVM.2017.12.1426-1434). The author recommends that any future rearing of *Thallis* from Agaricales should follow the guidelines of Schigel (2008). Dry forest soil, sand or other substrates of fine fraction should be included in rearing boxes and kept moist with a

Plate 2. Clusters of overlapping fruiting bodies of *Omphalotus nidiformis* growing from the base of a eucalypt stump at Riverside, Launceston, Tasmania. Photograph: Simon Fearn.

'mister bottle'. Extreme moisture must be avoided however to prevent mould growth and keeping some dry *Sphagnum* in the container will help to balance moisture levels.

Concluding observations

Although the data in this work are limited, they may indicate two generations of *T. compta* per year, i.e. adults active in spring, with larval, pre-pupal and pupal stages completed in around 3 months, and a second generation of adults appearing in late summer/autumn. This may indicate a biannual strategy based around the peak fruiting period of host fungi in the mildest and wettest parts of the year. Such a strategy would increase the likelihood that discrete patches of fruiting bodies could be colonised by adult beetles quickly while they were still in peak condition.

Little is known about Tasmanian mycophagous insects, and a great deal could be learned by collecting fruiting bodies and rearing out the associated insect species. It is important however to lodge voucher specimens with recognised institutions (museums and herbariums) of both fungal hosts and insects with as much associated information as possible.

Acknowledgements

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New distribution and foodplant observations for several Coleoptera species in the Tasmanian Central Highlands, Summer 2017

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As a continuation of our research into the ecology of the Miena jewel beetle, *Castiarina insculpta* Carter 1934 (Spencer & Richards 2014, Richards & Spencer 2016) and that of *Castiarina rudis* Carter 1934, eight survey excursions to various parts of the Central Highlands were conducted between January and March of 2017. While the principal focus of the investigation was Buprestidae, observations of species of Lucanidae and Cerambycidae were also recorded.

The 2017 season again proved to be supportive of the theory that the larval cycle of *C. insculpta* is of two years duration, with high numbers of the beetles recorded. *Castiarina insculpta* activity was evident from early January (with flowering just commencing) and extended into March, making this the most protracted active season so far documented. *Ozothamnus hookeri* (scaly everlastingbush) flowering continued for longer than previously observed, with strong blossom persisting from mid-January to early March.

New localities for *C. insculpta* were confirmed in 2017 (Table 1). Two of the locations, Gunns Marsh Road (Arthurs Lake) and Waddamana Road were visited by us in 2016, when potential emergence holes were detected. Along with these sites, Westons Road (Great Lake), and Marlborough Highway all constitute range extensions for the species and collectively, increase the extent of occurrence from 388 km^2 in 2016 to 680 km^2 (both figures exclude Great Lake). At 840 m, the Marlborough Hwy site is the lowest elevation where *C. insculpta* has been located. In this instance the animal was nestled deep within the inflorescence, but became active when disturbed; the temperature (9°C) is the lowest at which we have recorded *C. insculpta* activity. While the above sites have extended the range of the species, it must be noted that the population densities measured by beetle and emergence hole presence at each of these locations was found to be low.

Previously, we reported a new adult food plant for *C. insculpta* (Richards and Spencer 2016), and again this year we recorded a female *C. insculpta* on flowering *Baeckea gunniana* (alpine heathmyrtle). In this instance, the shrub was surrounded by an ocean of flowering *O. hookeri* on the shore of Lake Augusta, but no other buprestids were present.

First visited by us in 2013, an outlying population of *O. hookeri*, on the Lyell Highway, was again investigated for *C. insculpta* presence. At 720 m elevation, this site is intriguing as a considerable area (>1 hectare) of *O. hookeri* with numerous emergence holes consistent in size and shape with those attributed to *C. insculpta* exist. Despite warm conditions and bountiful blossom, the only buprestids recorded were *Castiarina wilsoni* Saunders 1868, and these were in abundance. This raises the question, are *C. wilsoni* at this location utilising *O. hookeri* as the larval food plant? The authors propose to resolve this conundrum in the following summer seasons; interestingly we have never before recorded *C. wilsoni* adults feeding on *O. hookeri* blossom.

Castiarina wilsoni is a native species widespread in Tasmania, occurring from sea level to the Central Plateau. Cowie (2001) lists the adult food plants as *Helichrysum, Cassinia, Bursaria* and *Leptospermum*. In addition to these, the authors have observed adults on a range of plants including: *O. hookeri, Baeckea, Myoporum, Ozothamnus ericifolius, Lomatia, Daucus* (carrot), *Allium* (onion), *Pastinaca* (parsnip) and *Carum* (caraway). The larval food plant for *C. wilsoni* is not currently known.

Across the survey period three additional *Castiarina* species were observed on *O. hookeri* blossom; *C. thomsoni* Saunders 1868, *C. leai* Carter 1916 and *C. virginea* Erichson 1852. Single specimens of both *C. thomsoni* and *C. leai* were recorded, the former, a male, was the recipient of the sexual advances of an amorous male *C. insculpta*.

Castiarina thomsoni and *C. leai* are native species, found across the eastern states, and are common and widespread in Tasmania, from coast to the Central Highlands. Cowie (2001) lists *Bursaria, Helichrysum, Leptospermum* and *Cassinia* amongst the adult host plants for *C. thomsoni* and *Leptospermum*, *Olearia* and *Baeckea* for *C. leai*. The larval host plants are unknown for either species. As a result of our 2017 surveys, *O. hookeri* is now recognised as an additional adult food plant for each of these species.

Castiarina virginea is endemic to Tasmania, belonging to the rectifasciata group along with *C. insculpta* (Barker 2006). It has a wide distribution from Hobart/Bruny Island to Port Latta and occurs from sea level to alpine elevations approaching 1000 m. The species is patchy across its range and we are yet to record more than two individuals in any survey. The larval host plant is not known, but adults have been taken on *Helichrysum, Cassinia* and *Bursaria* (Cowie 2001). The authors have recorded adults on *O. hookeri, Baeckea gunniana, Epacris petrophila, Leptospermum scoparium* and *L. lanigerum* adding to the list of adult food plants.

Castiarina rudis Carter 1934 is another Tasmanian endemic occurring across much of the Central Highlands. Our research has identified the larval host plant for this species as *Orites revolutus*.

Table 1. Central Highland buprestid observations for 2017.

Date	Location	Species	Comments
7/01/17	Lake Ada	*C. insculpta* *C. rudis* *C. virginea*	2 ***c i*** at Liawenee, both on buds with no flower open. 1 ***c v*** on *Epacris petrophila.* Multiple ***c r*** active, mostly males.
27/01/17	Lake Ada	*C. insculpta*	8 ***c i*** in 1 hour survey, 20° C
27/01/17	Liawenee	*C. insculpta* *C. thomsoni*	>80 ***c i*** 20 minute survey, multiple males attempting to mate, one mating a male ***c t***, 24° C
27/01/17	Marlborough Hwy	*C. insculpta*	24 ***c i*** 10 minute survey, 24° C
27/01/17	Skullbone Plains	*C. insculpta*	30 ***c i*** 20 minute survey, 24° C
7/02/17	Liawenee	*C. insculpta* *C. virginea*	49 ***c i*** 2 hour survey, sluggish but flying, 1 ***c v*** on *O. hookeri,* 12° C
7/02/17	Tods Corner (Great Lake)	*C. insculpta* *C. virginea*	9 ***c i*** 35 minute survey, 1 ***c v*** on *O. hookeri*, 14° C
7/02/17	Waddamana Rd	*C. insculpta*	1 ***c i*** 10 minute survey, 15° C (emergence holes recorded 7/08/16).
14/02/17	Westons Rd (Great Lake)	*C. insculpta* *C. rudis*	2 ***c i*** 30 minute survey, ***c r*** emergence holes & larval activity, 14° C
14/02/17	Gunns Marsh Rd (Arthurs Lake)	*C. insculpta*	2 ***c i*** 30 minute survey, 13° C (area visited 22/01/16)
14/02/17	Tods Corner (Great Lake)	*C. insculpta* *C. virginea*	3 ***c i*** 20 minute survey, 1 ***c v*** on *O. hookeri*, 14° C
15/02/17	Marlborough Hwy (TLC property)	*C. insculpta*	1 ***c i*** 20 minute survey, multiple emergence holes, animal deep in blossom, elevation 840 m, 9° C
15/02/17	Lyell Hwy	*C. wilsoni*	Multiple ***c w*** 30 minute survey, many emergence holes, elevation 720 m,18° C
22/02/17	Lake Mackenzie	*C. rudis*	3 areas with considerable amounts of *O. hookeri* were targeted, abundant flower available but no ***c i*** adults or emergence holes were located. Emergence holes & larval activity of ***c r*** were noted, 15° C
22/02/17	Liawenee	*C. insculpta*	8 ***c i*** 10 minute survey, 15° C
4/03/17	Tin Hut Track	*C. insculpta* *C. rudis*	1 ***c i*** 15 minute surveys at 3 sites, all yielded emergence holes. Emergence holes & larval activity of ***c r*** were noted, 20° C
4/03/17	Little Blue Lagoon	*C. virginea*	1 ***c v*** on *B. gunniana* blossom, 20 minute survey. Multiple ***c i*** emergence holes in *O. hookeri*, 20° C
4/03/17	Carter Lakes	*C. insculpta*	3 ***c i*** 10 minute survey, 17° C
5/03/17	Lake Augusta	*C. insculpta* *C. rudis*	3 locations not previously visited all yielded emergence holes for ***c i*** & ***c r***. 1 ***c i*** found feeding on *B. gunniana* blossom in *O. hookeri*-dominated vegetation. 16° C
5/03/17	Liawenee	*C. insculpta* *C. virginea*	3 ***c i*** 10 minute survey. 1 ***c v*** on *O. hookeri*, most flowers finished, 19° C

Note: c i = *Castiarina insculpta,* c r = *C. rudis,* c t = *C. thomsoni*, c v = *C. virginea,* c w = *C. wilsoni.*

We have no records of adults feeding, and although images exist of specimens on *Ozothamnus hookeri* (Natalie Tapson 2012), our observations suggest activity including mating is centred on *O. revolutus.* Flowering of the host plant occurs between December and early January; however, adult *C. rudis* first become active in late January, making it impossible for *O. revolutus* to be the nectar source exploited by *C. rudis.* Cowie (2001) lists *C. rudis* as occurring at Lake Dobson and Lake St Clair with an outlier at Wineglass Bay; and records the host plant as *Leptospermum* spp Barker (2006) lists the distribution as Great Lake, Lake Dobson and Lake St Clair. Thus far, no museum record for *C. rudis* at Lake St Clair has been found, but a record exists on the Atlas of Living Australia (ALA) of a specimen collected by F. Evans near Cradle Mt in 1964, which may prove to be the record cited as being from Lake St Clair.

The authors currently map the distribution of *C. rudis* as Lake Mackenzie, Lake Augusta, Carter Lakes, Ada Lagoon, Lake Ada, Great Lake, Arthurs Lake and Barren Tier. The recent collection of a dead female specimen in April 2017 at Ben Lomond by field naturalist Kristi Ellingsen may shed some light on the Wineglass Bay specimen, as this is the closest record of *C. rudis* to date, and no records of *O. revolutus*, the known larval host plant, exist in the vicinity of Coles Bay on the Natural Values Atlas (NVA). The nearest location for *C. rudis* to Freycinet (NVA data) is Mount Durham on the Nicholas Range; however, the location description for this record is Ben Lomond. Adult *C. rudis* are very strong and fast flyers and given a tail wind it is not inconceivable that a specimen may reach the coastline from Ben Lomond and wash to the Wineglass Bay collection site.

Plate 1. *C. rudis* in copula

Currently we do not know where on the plant *C. rudis* oviposit but we have observed multiple matings occurring in the upper foliage of *O. revolutus* (Plate 1). We note that the larvae of *C. rudis* generally travel down the stem, often to and below ground level, and adults emerge from a typical "D-shaped" hole usually within 30 cm of ground level (Plate 2).

Larvae of the native cerambycid beetle *Uracanthus pallens* Hope 1841 have also been identified utilising *O. revolutus,* at times occupying large stems which also host a *C. rudis* larva. The final instar larvae of both species are of similar dimensions; (approximately 40 mm in length); however, they are readily differentiated using external structures. The larva of *C. rudis* displays a well-defined, sclerotized, "Y-shaped" pronotal groove and undeveloped dorsal ambulatory ampullae, whilst *U. pallens* larva lack sclerotisation of the pronotal groove, exhibit well developed glabrous ambulatory ampullae, also possess legs and spiny processes on the 10th abdominal segment (Plate 3).

Plate 2. Female *C. rudis* emergence hole

Larvae of both beetle species are stem borers and eject large quantities of frass. Uracanthus pallens oviposit in the upper branches of the host plant and larva descend, hollowing out the stem to approximately half its length, at this point the stem is girdled (Plate 4), where it breaks off and the larva remains developing in the dying stem (K.M Moore in Duffy 1963). Post-pupation, adults exit the stem leaving a rounded-oval shaped emergence hole.

We observed two adult specimens of *U. pallens* at Carter Lakes in December

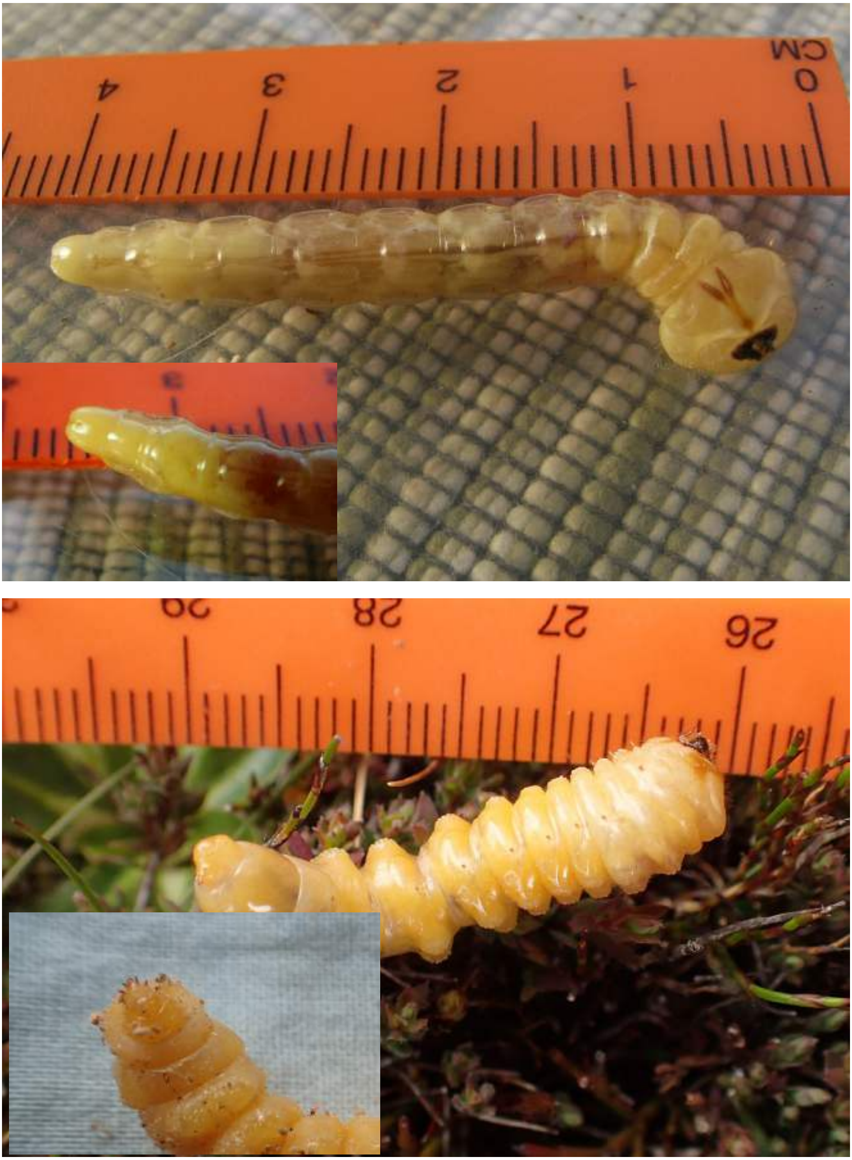

Plate 3. Comparative larval anatomy, Upper: *Castiarina rudis* dorsal view. Lower: *Uracanthus pallens* dorsolateral view. Inserts: show structure of tenth abdominal segments.

Plate 4. Girdled stem of *Orites revolutus*

Plate 5. *U. pallens* adult

2016 on *Grevillea australis* blossom. Adults are known to feed on the blossom of species of *Angophora*, *Eucalyptus, Kunzea, Leptospermum, Melaleuca* and *Xanthorrhoea*, while the larvae have been recorded utilizing native species including *Acacia, Boronia, Banksia, Eucalyptus, Hakea* and *Lomatia* as well as exotic species such as *Litchi*, *Prunus* (plum and apricot) and *Citrus* (Thongphak & Wang 2007; Slipinski & Escalona 2016). We successfully reared out specimens of *Uracanthus* from ultimate instar larvae occupying *O. revolutus* stems (Plate 5). Although the imagines are consistent with the description of *U. pallens*, the larvae more closely resemble those attributed by Duffy (1963) to *U. triangularis* Hope 1833.

Our final observation for the season relates to the lucanid *Lissotes obtusatus* Westwood 1838. Two dead female *Lissotes* specimens were collected from the Carter Lakes sand dunes in the summer of 2015 and 2016 respectively; however, positive identification of most *Lissotes* species is based on male characters (Lea 1910). Verification of the species identity occurred in 2017 when we recorded a fine male *L. obtusatus* crossing the Ada Lagoon track; this record represents the highest elevation at which we have observed this widespread species. *Lissotes obtusatus* larvae are generalists, occupying decaying wood or the soil-wood interface. At this alpine location wood of sufficient dimensions to accommodate *Lissotes* larvae is in very short supply, leaving us at a loss to explain where the lengthy (>two years) larval development occurs.

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Ben Lomond Camp Trip Report

14-16 April 2017

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Roughly every two years our club hosts an Easter Camp. A major reason for choosing Ben Lomond as the venue for this Easter camp was that most of us had either not been there at all, or not spent that much time exploring the area. We originally intended to go to Ben Lomond in 2016, but it was difficult to arrange an appropriate venue in time. Roll on 2017 and there was an extra reason to go: it was loosely our "turn" to host the Federation Weekend, and Ben Lomond would be a conveniently close location for many members of other clubs. Therefore, the 2017 Easter Camp went ahead as a combined TFNC Easter Camp and statewide Federation weekend.

Our venue was the Rover Ski Lodge on top of the mountain (Plate 1).We found this to be spacious with excellent facilities and very good value for money and thank the caretakers there for helping us get settled in. Ultimately 34 adults and six children booked for the weekend, mostly from our club but with several from other clubs as well.

Plate 1: Easter Camp participants gathered in front of the lodge.
Photograph: Amanda Thomson

The Federation - then and now

The Federation may be a mysterious institution to some readers, so I'll briefly explain: the Federation of Field Naturalists Clubs of Tasmania was founded in the mid-1950s as a peak body for the then four clubs in the state. In the next few decades it became a significant lobby group for conservation, a role that persisted until about the mid 1990s when this was overtaken by many of the more specialised conservation groups. (The Federation's six-monthly meeting schedule wasn't exactly geared for rapid response in the electronic age either.) Since then the Federation has functioned mainly as a meeting point for groups of naturalists from different clubs to get together and explore different venues around the state. This has led to an end to the former practice of "federation meetings" of club delegates and the meetups are now known simply as Federation Weekends.

With increasing competition from other naturalist excursions such as the national Australian Naturalists Network and various "citizen science" endeavours, as well as gradual decline in the number of field naturalist and allied groups involved, it has become harder over time to organise Federation Weekends. From 2011 the Federation dropped down from two weekends a year to one, and there has been some discussion about dropping back to every two years or even abolishing the Federation altogether.

It was hard for us to determine how much interest still remained in the Federation given this, so we decided on a "build it and see if they come" approach, on the grounds that even if they didn't we could say we'd ticked the box for our turn and done our best to keep it going. At this particular Weekend there were a range of views about the Federation, from those who were enthusiastic for it to continue to those who believed it should be axed. That some of the latter view had actually attended made the proper future status of the Federation all the more perplexing!

The program and outings

We were fortunate to have two excellent talks in the evenings - with one "home" and one "away" speaker, so to speak. Our own Dr Genevieve Gates presented results from fungal diversity at Warra, including some truly staggering numbers for species in the same genus that could be found on a single plot. Our second speaker was Sarah Lloyd, who gave us an insight into the weird and wonderful world of slime moulds, as featured in her ominously titled book "*Where the slime mould creeps*".

The official outing was to Little Hell, a 5 km circuit through alpine vegetation and rock summits following a loosely formed route along ski poles (Plates 2 and 6). We were blessed with a beautiful day for it and the completion rate for the challenge was very high. The sparse alpine vegetation, geological formations and views across the large plateau to two distant and difficult to access lakes were among the highlights of this walk.

However, with some members struggling with the continually up-and-down terrain and boulder-hopping, your President had the seemed-like-a-good-idea at the time notion that perhaps the gently downhill Surprise Vale "track" intersecting with the Little Hell circuit might make for an easier return. Alas, it turned out that the Surprise Vale track, while usefully lacking in hills, was more concerningly lacking in *track*, plunging our intrepid heroes into vicious thickets of the bane of the Ben Lomond cross-country walker, *Richea scoparia*. (An unpleasant surprise, to say the least.) The "easy" way in the end took over half an hour longer than the "hard" way. Dramatic tales even emerged of how one young adventurer had to take over leading the side-party, because everybody knows of course that adults are useless in a crisis!

(This was not the first brush with danger for our younger scientists - on the way up Little Hell one had discovered what it is like to disturb a colony of alpine huntsman spiders. There was the usual surprised yelp followed by the comical sight of dozens of spiders scrambling and in the case of dead specimens, blowing across the nearby rock face.)

On the final day, a morning raid on Hamilton Crags was advertised as a second official outing. As those willing and able assembled outside the Lodge at somewhere near the appointed time, dense mist blew up from Strickland Gorge and thereafter vistas of the Crags were very fleeting. The advance party (Amanda Thomson and Fiona Walsh), who had left for the Crags a few minutes early, were surprised to find nobody else was coming and had an invigoratingly wild weather experience on their way up.

Plate 2: Alpine tarn on the Little Hell track
Photograph: Amanda Thomson

The lookout on the Crags was a popular destination for unofficial side trips especially as it offered a high chance to photograph *Veronica* (formerly *Chionohebe*) *ciliolata*, a cushion plant that grows there and nowhere else except New Zealand (Plate 3). This species is unusual in growing on the rocky mountain slopes rather than on the moors and valley floors like the other local cushion plants. TFNC Life Member Dr David Ratkowsky was involved in the discovery of the Tasmanian population decades ago and since then, its presence in Tasmania at just this location has continued to fascinate naturalists. Is it "native" or "exotic"? If the former, is it a remnant of a wider population or a disperser from New Zealand, and if the latter how did it get there? Those looking for the species generally had little difficulty finding it, though in some cases more trouble recognising it. "Oh, I don't think we saw it" "Show me your photos (flicks through) ... there it is!"

Plate 3: *Veronica ciliolata* spp *fiordensis*
Photograph: Amanda Thomson

Another common destination was one of the few actual walking tracks on the mountain, to the summit of Legges Tor. Also, on the way down on the final day some members walked part-way up the track from Carr Villa, where a mountain rocket plant with bright yellow fruits attracted some attention (Plate 4). Yours truly undertook a less orthodox foray, walking down and up Jacobs Ladder in the same afternoon (14 minutes down, 30 up) in order to get below the treeline and get in some time sampling snails on this remarkably under-sampled (for snails, that is) mountain.

Plate 4: The yellow mountain rocket, *Bellendena montana*
Photograph: Amanda Thomson

Natural history

As well as unusually large and fluffy wallabies, Ben Lomond is very much about dolerite. Some intriguing remnants of a nearly entirely weathered away sedimentary layer were found, but almost everything on the plateau is "the rock that makes Tasmania", and one sign on the way up noted the plateau as having Australia's largest expanses of alpine talus. Some wonderful formations were seen, especially involving columns that had been smoothed off at the top by ice (preserving hexagonal patterns on the ground) and clusters of columns that were in the process of collapse (Plate 5). Another aspect of the plateau generally is its windswept, stark, low-lying vegetation, as compared to other alpine areas of the state with their pandani and taller pines. It was interesting to read (in one of the many guidebooks available) that vegetatively the Ben Lomond plateau is quite different from other Tasmanian mountains and could be said to have more in common with the mountains of Victoria.

A detailed list of finds appears in the Appendix, but there are a few specific scientific highlights to mention. Firstly, Kristi Ellingsen found a dead jewel beetle near the top of Legges Tor. This was a female *Castiarina rudis,* a species that has been seen frequently in our jewel beetle expeditions to Lake Ada in recent years. The distribution of *C. rudis* is poorly understood - apart from the general Central Plateau/Lake St Clair area the species is also known from one beachwashed specimen from, of all places, Wineglass Bay. Jewel beetle expert Shelley Barker (pers comm) had seen *C. rudis* at Ben Lomond but not captured it, so this record was valuable confirmation of the species' presence (at least as of a month or two before) in the area.

Secondly, in my two previous trips to the Ben Lomond alpine area, I had failed to find any land snails at all (a rare experience, though very high areas in Tasmania usually support quite low diversities). This time it took me just 15 minutes searching just 50 metres from the Ski Lodge to find a very small member of the family Punctidae in the litter of *Podocarpus lawrencei* (a typically prostrate conifer that often sprawls over rocks in the area). In all Abbey and I were able to find 24 specimens of this 1.4 mm wide mollusc in the next half an hour - alas, only one of them alive. Attempts to repeat this effort on the Little Hell walk failed and failed and failed until I finally found another two dead ones in the same way near the high point of the walk at Giblin Peak. The punctid is a completely new species and, while somewhat resembling the lowland genus *Paralaoma*, is so distinctive it may require its own genus. (Another punctid I collected at two sites near Carr Villa may also be new but more material and work is needed to confirm that.)

Thirdly, a millipede collected alongside the snails has proved to be a new (and particularly smelly) species in the diverse genus *Lissodesmus*. Bob Mesibov and I intend to conduct more searching for it later this spring.

Plate 5: 'Sorted polygons' formed though frost weathering in dolerite debris, evidence of a periglacial climate.

Photograph: Amanda Thomson

Thankyou

The camp was highly successful. My thanks to everyone who attended and all who helped in any way. Particular thanks are due to our program officer Amanda Thomson (pre-camp organisation), our treasurer Anna McEldowney (for her super-efficient approach to getting everyone to pay in advance!), our secretary Margaret Warren (for raising interest among other clubs) and our librarian Annabel Carle for her fine catering with nibbles and work in compiling the lists included in this volume.

We shall now consider our next destination!

Appendix

All lists compiled by Annabel Carle

Fauna - Ben Lomond April 14-16 2017

BIRDS		
	Black Currawong	Silvereye
	Flame Robin	Tasmanian Scrubwren
	Forest Raven	Wedge-tailed Eagle
	Richards Pipit	

Plate 6: On Hells Circuit
Photograph: Amanda Thomson

AMPHIBIANS
Crinia tasmaniensis -Tasmanian froglet – adults and tadpoles – in deeper ponds only i.e. more than 50cms deep.
BEETLES
Ground beetles - *Scopodes* sp. & *Promecoderus* sp. (or similar) and several others *Dasytomima rachaelae* (or similar Pollen feeding beetle) *Chrysomelid* leaf beetles - *Paropsisterna bimaculata* & *Peltoschema* sp. *Castiarina rudis* -Jewel beetle (dead) Dytiscidae - Diving beetles/Water Boatman
BUGS
Lygaeidae – Nysius sp - Seed bugs - in huge numbers when it warmed up on cushion plants Cf. Delphacid planthopper Aphid Cercopidae – Spittlebug Cicadellidae – Leaf hopper
SPIDERS
Harvestman spiders Wolf spider – Amanda – ID pending from J Douglas Forest hunter/Mygalomorph spider ID pending from J Douglas
FLIES AND WASPS
Wasp Mosquito larvae Caddis fly larvae in large numbers Chironomids on stems over cushion plants. Male & female feathered antennae
CATERPILLARS, MOTH AND BUTTERFLIES
Anthelid caterpillars & moth.

SNAILS/SLUGS
Tiny snails in family Punctidae found in leaf litter of *Podocarpus lawrencei* *Deroceras reticulatum* – an exotic lettuce slug
OTHER SNAILS/SLUGS FROM CARR VILLA HUT AREA:
Cayodes dufresnii *Allocharopa kershawi* (soon to be moved to new genus*)* *Prolesophanta* sp (juvenile*)* *Cystopelta petterdi* *Gratilaoma sp* "Knocklofty" *Pedicamista* cf. sp "Bull Hill"
MILLIPEDES
Tasmaniosoma hickmanorum *Lissodesmus* sp nov Undescribed dalodesmid (known species)
OTHERS
Centipede Field Cricket (*Bobilla* sp.) Southern Pyrgomorph – *Monistria concinna* & other grasshoppers

Plate 7. Southern pyrgomorph, *Monistria concinna*
Photograph: Amanda Thomson

Plants - Ben Lomond April 14-16 2017

Scientific name	Comments
HAMILTON CRAGS/AROUND SKI VILLAGE/LITTLE HELL CIRCUIT	
FERNS/FERN ALLIES AND CONIFERS	
Blechnum pennamarina ssp *alpina* - Alpine Water-fern	
Huperzia/Lycopodiella sp - Club mosses	
Podocarpus lawrencii - Plum Pine	In fruit -new species of snail found underneath this plant!
MONOCOTS	
Astelia alpina - Pineapplegrass	Tas Endemic
Empodisma minus - Spreading Roperush	
Carpha alpina - Small Flower-rush	
Poa sp	
Rytidosperma sp (*Austrodanthonia* sp)	
DICOTS	
Asteraceae	
Arbrotonella forsteroides - Eastern cushion plant	Tas Endemic
Argyotegium/Euchiton sp - daisy in cushion plant	Possibly *Argyotegium fordianum*
Cotula alpina - Alpine Cotula	
Craspedia sp.	
Ewartia catipes - Diamond Cushionherb	Tas Endemic
Microseris lanceolata - Alpine Yamdaisy	In flower
Olearia obcordata - Heartleaf Daisybush	Tas Endemic
Ozothamnus rodwayi ssp kingii - Alpine Everlast-ingbush	In fruit -Tas Endemic
Pterygopappus lawrencei	Cushionplant -Tas Endemic
Senecio gunnii - Mountain Fireweed	
Senecio pectinatus var pectinatus - Alpine Groundsel	
Campanulaceae	
Wahlenbergia saxicola - Mountain Bluebell	In fruit

Droseraceae	
Drosera sp	Probably *D. arcturi*
Ericaceae	
Epacris serpyllifolia - Alpine Heath	Tas endemic
Gaultheria tasmanica - Tasmanian Waxberry	Tas Endemic
Pentachondra pumila - Carpet Frillyheath	Flower and fruit
Richea acerosa - Eastern Candleheath	Tas Endemic
Richea scoparia - Scoparia	Tas Endemic
Richea sprengeloides - Rigid Candleheath	Tas Endemic
Gentianaceae	
Gentianella diemensis - Tasmanian Snowgentian	Tas Endemic – in flower
Myrtaceae	
Baeckea gunniana - Alpine Heathmyrtle	
Onagraceae	
Epilobium sp	
Orobanchaceae	
Euphrasia collina ssp diemensis - Purple Eyebright	Tas Endemic
Plantaginaceae	
Ourisia integrifolia - Mountain Whitebell	Old flowers/fruit - Tas Endemic
Veronica ciliolata ssp *fiordensis*	Cushion bush
Proteaceae	
Bellendena montana - Mountain Rocket	Tas Endemic - Fruit - red, yellow/orange forms
Lomatia tinctoria - Guitarplant	Tas Endemic
Orites acicularis - Yellow Orites	Tas Endemic
Orites revolutus - Revolute Orites	Tas Endemic
Rosaceae	
Acaena montana - Alpine Buzzy	
Rubiaceae	
Coprosma nitida - Mountain Currant	

Coprosma pumila - Dwarf Coprosma	
Santalaceae	
Exocarpos humifusus - Mountain Native Cherry	Little Hell Circuit
Winteraceae	
Tasmannia lanceolata - Mountain Pepper	
CARR VILLA HUT TRACK AND SURROUNDS	
LICHENS	
Cladonia sp	With fruiting body
Usnea sp	
Cladia aggregata	
Cladia retipora – Coral lichen	
FERNS/FERN ALLIES AND CONIFERS	
Huperzia/Lycopodiella sp - Club mosses	
Polystichum proliferum - Mother Shield Fern	
MONOCOTS	
Astelia alpina - Pineapplegrass	Tas Endemic
Carpha alpina - Small Flower-rush	
Oreobolus oligocephalus - Large Tasmanian Tuft-rush	Tas Endemic
Poa sp	
DICOTS	
Apiaceae	
Hydrocotyle sibthorpioides	
Asteraceae	
Craspedia sp?	Leaves only
Ozothamnus rodwayi var *kingii* - Alpine Everlastingbush	Tas Endemic
Senecio gunnii?	Grey basal leaves/rosette
Campanulaceae	

Wahlenbergia saxicola - Mountain Bluebell	In fruit
Droseraceae	
Drosera sp	Probably *D. arcturi*
Ericaceae	
Cyathodes glauca - Purple Cheeseberry	
Cyathodes straminea - Small-leaf Cheeseberry	
Epacris serpyllifolia - Alpine Heath	Tas endemic
Leptecophylla juniperina - Pinkberry	
Monotoca empetrifolia - Mat Broomheath	In bud
Richea scoparia- Scoparia	Tas Endemic
Richea sprengeloides - Rigid Candleheath	Tas Endemic
Fabaceae	
Oxylobium ellipticum - Golden Shaggypea	Flower and fruit
Geraniaceae	
Geranium potentilloides var *potentilloides* - Mountain Cranesbill	
Haloragaceae	
Gonocarpus teucrioides - Alpine Raspwort?	Leaves only
Lamiaceae	
Westringia rubiifolia - Sticky Westringia	Just still in flower - Tas Endemic
Myrtaceae	
Baeckea gunniana - Alpine Heathmyrtle	
Eucalyptus archeri	No fruit
Leptospermum rupestre - Mountain Teatree	
Onagraceae	
Epilobium sp	
Pittosporaceae	
Pittosporum bicolor - Cheesewood	In fruit

Proteaceae	
Banksia marginata - Silver Banksia	
Bellendena montana - Mountain Rocket	Tas Endemic - Fruit - red, orange and an all yellow form
Grevillea australis - Alpine or Southern Grevillea	In bud
Orites revolutus - Revolute Orites	Tas Endemic
Telopea truncata - Tasmanian Waratah	Tas Endemic
Rosaceae	
Acaena/Sanguisorba sp.	Leaves only
Rubiaceae	
Coprosma nitida - Mountain Currant	
Asperula gunnii	Leaves only
Stylidiaceae	
Stylidium armeria ssp *armeria*	In fruit with basal tuft of wide veined leaves
Violaceae	
Viola sp?	Leaves only
Winteraceae	
Tasmannia lanceolata - Mountain Pepper	Heavily in fruit

Plate 8. *Gentianella diemensis*
Photograph: Amanda Thomson

Book Reviews

A Guide to Stag Beetles of Australia

By George Hangay and Roger de Keyzer.

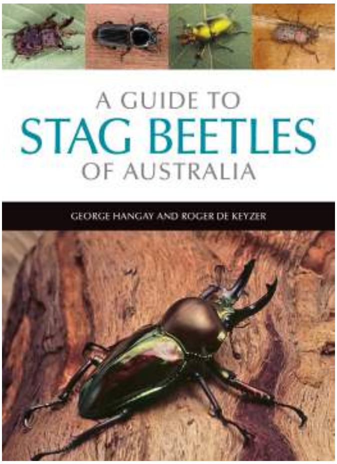
CSIRO Publishing. 2017

Reviewed by: Mike Bouffard* and Jo Bornemissza

***51 Alburys Rd, Huonville Tas. 7019.**

michaelbouff@gmail.com

Format: Paperback, 264 pp. 21.5 x 14.8 cm.



A Guide to Stag Beetles of Australia, is an absolute 'must-have' for anyone who is interested in this family of beetles.

The book is written in such a way that both the expert and the amateur will find it beneficial. It is set out in a logical and orderly fashion and describes all currently known ninety five species found in the Australian region.

Not only are the physical attributes of the species listed in detail, but also their biology, distribution, history of classification and how each differs from closely allied species, which is extremely helpful. It also includes any additional

'tid bits' that are known about the species, in addition to which there are clear photos of each species, as well as a number of their habitats.

For those who are not yet accomplished in the science of collecting, there is a section on how to find stag beetles, collect them, rear them and preserve them.

This book will undoubtedly be a classic as a guide to an insect family in Australia and will be a valuable asset for the naturalist for years to come.

Fleeting Hopes A history of Port Davey, South West Tasmania, Volume 1

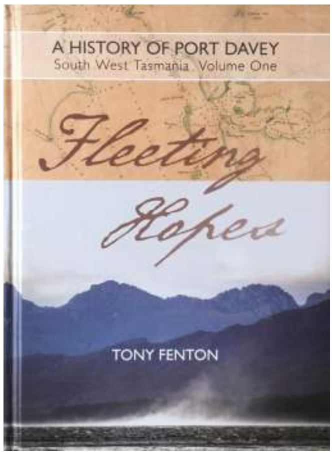
By Tony Fenton

Forty South Publishing Pty Ltd 2017

Reviewed by: Deirdre Brown

deirdre.e.brown@gmail.com

Format: Hardback, 312 pp. 18 x 25 cm.



Port Davey, in the South West wilderness, has a surprisingly voluminous history of exploration, occupation and exploitation which may surprise bushwalkers and naturalists.

Tony Fenton, with painstaking research, has unearthed a huge amount of historical documentation about an area I had often thought of as lightly visited wilderness. He has impeccable credentials to write this book. As the grandson of Deny King "the legendary tin-miner and naturalist of Melaleuca" he spent many childhood holidays there, and has made numerous visits as an adult, giving him an intimate knowledge and love of the environs.

Tony writes in the Introduction, "As I researched, the concept of many unrelated events gave way to the realization that the history was multi-stranded with threads in Tasmanian, Australian and world history."

It is these threads that the author has assiduously followed to weave into a coherent and absorbing account and to produce a major work about the area and its place in the larger historical context, from pre-history to 1914. We will have to wait until Tony produces Volume 2 to read about Port Davey from WW1 to the present.

Fleeting Hopes is not only a good read, but an important reference, with extensive bibliography, annotations/references (as endnotes), historical and contemporary photographs and maps, and other useful information including a brief overview of the period covered in Volume 1.

The production is first class. Layout and the pleasant tactility of the book add to the author's erudition to make the whole reading experience a pleasure.

A Field Guide to Tasmanian Fungi - Second Edition

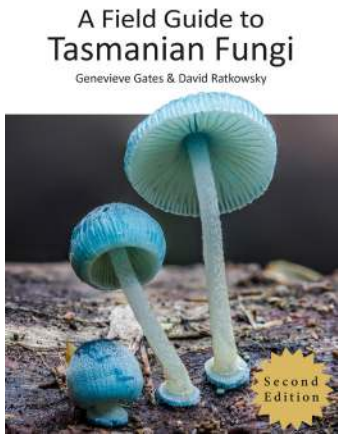
By Drs Genevieve Gates and David Ratkowsky

Tasmanian Field Naturalists Club Inc. November 2016

Reviewed by Don Hird

donh1952@gmail.com

Format: 250 pages, including 650 colour illustrations, A5 (21 cm x 15 cm.)



A longstanding custom of naturalists is to list observations, making use of the shared expertise of the participants. Until a decade or so ago fungi would be duly noted at the most superficial levels, coral fungi, jelliies, parasols, brackets etc. Not only were such categories approximate, they are not natural groups indicating true relationships. They are, however, retained as quick identification guides.

A glance at this, the second edition, indicates how far Tasmanian Field Naturalists, in this case, have come. This volume adds some 50 or so additional species to the first edition, retaining or enhancing the quality of the photographs for each, and bringing the total to around 600.

Tasmania is renowned for its ancient forest lineages and some of the recent additions reflect the Gondwanan links that are retained with Patagonian fungi. Another local opportunity is the accessibility of many forest and other vegetation types, used by the authors and their team of helpers in over 1000 collecting and observing survey trips.

The original format from the first edition is retained, including the calendar of monthly observations for each species. While useful, it would seem that the opportunistic nature of fungi may at times contradict prior observations, particularly when rainfall patterns have been uncharacteristic.

That a small state like Tasmania can produce such comprehensive and high quality volumes as this is a credit to the authors and the helpers that they have inspired.

Sponsorship

The Tasmanian Naturalist is published annually, with printing and distribution costs sourced directly from membership fees. With ever increasing costs to production and the Club's recent shift to a higher quality presentation of the journal, which includes perfect binding, better quality paper and full colour, the Club now looks for support to offset the higher costs of production each year.

As well as the printed version of The Tasmanian Naturalist, electronic copies of every edition since inception are available on our website at:

http://tasfieldnats.org.au/naturalist/

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Advice to contributors

The Tasmanian Naturalist publishes articles on all aspects of natural history and the conservation, management and sustainable use of natural resources, with a focus on Tasmania and Tasmanian naturalists. These can be either in a formal or informal style. Articles need not be written in a traditional scientific format unless appropriate for the content. A wide range of types of articles is accepted. For instance, the journal will publish articles that:

- summarise or review relevant scientific studies, in language that can be appreciated by field naturalists;
- stimulate interest in, or facilitate in identifying, studying or recording particular taxa or habitats;
- record interesting observations of behaviour, phenology, natural variation or biogeography;
- stimulate thinking and discussion on points of interest or contention to naturalists;
- put the study of natural history today into context through comparisons with past writings, archives, etc.;
- review recent publications that are relevant to the study of Tasmanian natural history.

Book reviews, web site reviews, poetry and prose and other informal natural-history related content are also accepted. If you are thinking of submitting such material, please check with the Editor first, to avoid duplication of items such as book reviews and for appropriateness of content.

Submission of manuscripts

Manuscripts should be emailed to the editor at mickjbrown1@outlook.com or to the Club's address. Contact the Editors (see the Club's website for current contact details) prior to submission if you have any issues to discuss. Formal articles should follow the style of similar articles in recent issues and include an abstract. Informal articles need not fit any particular format and need not have an abstract. Unless otherwise stated, all images are by the author(s). Formal articles will be refereed. Responsibility for accuracy and currency of taxonomic nomenclature rests with the author(s). Please refer to the Guidelines for Authors, available on the Club's website.

Submissions should be provided electronically in standard wordprocessing files. Images, tables and diagrams should be submitted in separate files. It is important that they be of high resolution and suitable to be published at A5 size.

Articles must be submitted by 31 August to meet publication schedules.

Tasmanian Field Naturalists Club

G.P.O. Box 68, Hobart, Tasmania 7001
Founded 1904

Objectives

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

Activities

Members meet on the first Thursday of each month in the Life Sciences Lecture Theatre 1 at the University of Tasmania at Sandy Bay. These meetings include a guest speaker who provides an illustrated talk. An excursion is usually held on the following weekend to a suitable site to allow field observations of the subject of that week's talk. 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 annual 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. Members receive The Tasmanian Naturalist annually, plus a quarterly bulletin with information covering forthcoming activities, and the Club's library is available for use.

Prospective members should either write to the Secretary at the above address, or visit our website at:

http://www.tasfieldnats.org.au

Membership rates

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Junior	$25

Subscription rates for *The Tasmanian Naturalist*

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GST is not applicable -

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