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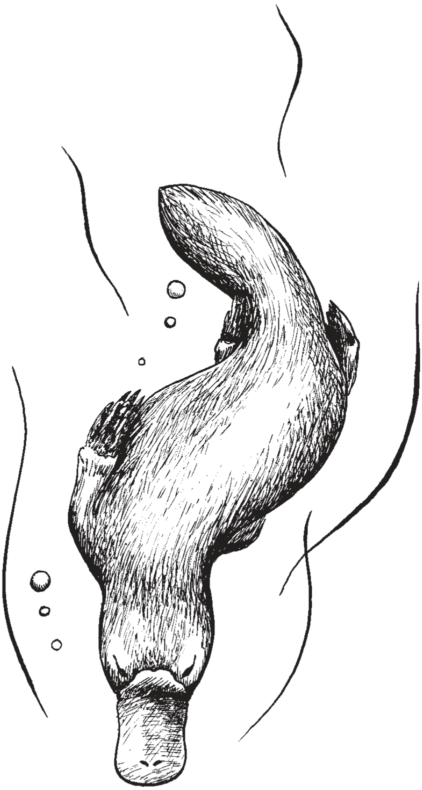

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A unique survey method for freshwater limpets leads to the rediscovery of *Beddomeia tumida* Petterd, 1889 (Mollusca: Tateidae) in *yingina*/Great Lake, Tasmania

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Abstract

The recovery of freshwater limpets following the 2015–16 low lake level and associated habitat dewatering event at *yingina*/Great Lake was investigated in 2021–22. Prior to the event, *Ancylastrum irvinae* (Petterd, 1888) (Mollusca: Pulmonata) had been recorded in high abundance at several shallow water locations around the lake (Richards et al. 2018), whereas the distribution and abundance of *A. cumingianus* (Bourguignat, 1853) (Mollusca: Pulmonata) was unknown. A new survey method using roofing tiles as an artificial substrate was successful in confirming persistence of *A. irvinae* in re-inundated habitat and locating two populations of *A. cumingianus*, and led to the rediscovery of the endemic tateid snail *Beddomeia tumida* Petterd, 1889 (Mollusca: Tateidae), which had until recently been considered likely to be extinct. Deployment of roofing tiles proved to be a useful technique for gathering new information on freshwater fauna distribution and behaviour in *yingina*/Great Lake.

Background

The *yingina*/Great Lake freshwater ecosystem is unique in Tasmania, supporting many endemic aquatic crustacea, mollusca and freshwater fishes, including nine species listed as threatened on the Tasmanian *Threatened Species Protection Act 1995*, two of which, the caddisfly *Costora iena* Mosely, 1936, and the mollusc *Beddomeia tumida* Petterd, 1889, are considered likely to be extinct (Ponder et al. 1993; Barmuta 2013; Threatened Species Unit 2005; Threatened Species Section 2006, 2015). Several additional invertebrate species, either endemic to the lake or having regionally restricted distribution, are also present; two of these, the mountain shrimp *Paranaspides lacustris* Smith, 1908 and *Ancylastrum cumingianus* (Bourguignat, 1853), although not listed at state or national level, are recognised as Threatened on the IUCN Red List (Inland Water Crustacean Specialist Group 1996; Mollusc Specialist Group 1996). Thanks to considerable surveys (e.g. Fulton 1983a, 1983b) and targeted surveys undertaken by Hydro Tasmania (e.g. Hydro Tasmania Consulting 2007), the aquatic species list for *yingina*/Great Lake continues to grow, with several undescribed mollusc species only recently discovered (Richards et al. 2015; Entura & Richards unpub. data), while a recent review of *P. lacustris* has resulted in recognition of a second species, *P. williamsi* (Ahyong et al. 2017).

Water extraction for hydro-electric power generation, combined with seasonal inflow variability impacts the lake level of *yingina*/Great Lake and has imposed difficulties for sedentary and slow-moving, shallow-water–inhabiting invertebrate species and their associated eggs. While receding water levels expose substrate, high rainfall events increase water depth, at rates which may be unsuitable for mollusc migration. Even more agile invertebrate fauna such as the crustaceans *Paranaspides* Scott, 1935 spp. and *Onchotelson* Nicholls, 1944 spp., which use rocky substrate as shelter, can become stranded when water rapidly recedes (Richards et al. 2018).

Limitations exist for any survey method targeting aquatic fauna. For example, a single Ekman grab sample targeting benthic invertebrate fauna collects only a minuscule portion of the substrate, requiring multiple replicates to obtain a representative fauna sample, while grab sampling and dredging methods often fail to detect species sheltering beneath rocky substrate, and both methods require significant sample-processing time. SCUBA or snorkelling surveys have single-person dependencies involving lengthy person-hours and are reliant on suitable weather conditions, requiring sufficient water clarity for visual assessment of often difficult-to-see organisms. One positive of immersive methods, however, is the greater coverage of substrate. All such methods afford only a snapshot in time, limiting species presence/absence to the instant the sample was taken or visual assessment conducted.

As the managing authority, Hydro Tasmania, through its consulting arm Entura, has contributed significantly to researching the aquatic fauna of *yingina*/Great Lake. Considerable attention has been paid to establishing the presence and distribution of the mollusc fauna, including giant freshwater limpets, glacidorbids and *B. tumida*. In 2007–08 a tantalising glimpse of this fauna came from benthic samples collected in Elizabeth Bay. This not only provided additional information on the distribution of the glacidorbid *Benthodorbis pawpela* (Smith, 1979), but also allowed the detection of what was considered likely to be juvenile *B. tumida*. Subsequent dredging surveys targeting *B. tumida* and freshwater limpets failed to locate the species, although an undescribed species of glacidorbid, much larger than other species known to inhabit the lake, was uncovered. Further surveys conducted in 2013, and a short snorkelling survey in 2017, were also unsuccessful in detecting *Ancylastrum* or *Beddomeia* and the mollusc research was discontinued, only recommencing in 2021. Results of this current survey have proved the 2007–08 *B. tumida* identification to be incorrect; the specimens are now considered to represent a new, undescribed species of Tateidae (W. Ponder pers. comm.), taking the current total number of undescribed aquatic molluscs in *yingina*/ Great Lake to five.

During the summer of 2015–16, the combination of poor winter and spring rainfall and a failure of the Basslink electrical interconnector cable that connects Tasmania with Victoria forced Hydro Tasmania to be more reliant on the water resource of *yingina*/Great Lake, driving storage volume to fall to 10.5% effective storage. It should be noted that 0% effective storage is the normal minimum operating level to which the lake can be drawn down but this does not mean that the lake would be completely empty. The electricity generation at Poatina Power Station and associated drawdown rates during this period triggered a drawdown rule, requiring Hydro Tasmania to undertake monitoring of the spawning habitat of two threatened fish species, *Paragalaxias eleotroides* (McDowall & Fulton, 1978) and *P. dissimilis* (Regan, 1906) (Hardie & Macfarlane 2016). This monitoring, to assess risk of dewatering on fish ova, was undertaken by snorkelling at sites along the lake margin and inadvertently led to the discovery of Great Lake giant freshwater limpet populations at several locations. Because the dewatering event exposed a significant proportion of the lakebed, land-based surveys of the previously inundated lakebed could be undertaken, revealing many stranded and dying limpets and their egg capsules (Richards et al. 2018). Results from water-based *Ancylastrum* surveys confirmed the presence of two freshwater limpet species – a fact which had been forgotten until a second species, *A. irvinae* (Petterd, 1888), was identified from trout gut contents in 2015 (Richards et al. 2015; Richards et al. 2018). Given the numbers of stranded *Ancylastrum*, the likelihood of the dewatering event significantly impacting the population was considered high, as neither the biology nor the species' ability to recover were known.

Captive rearing of *A. irvinae* and *A. cumingianus* to document the species' biology and ecology was undertaken in 2016; their limited capacity for locomotion was considered likely to prevent speedy recolonisation of the lake's littoral zone (Richards et al. 2018). With that aspect of the biology of *Anyclastrum* spp. now documented, the effects of the dewatering event on the species required investigation. In 2021, Hydro Tasmania began a survey of the distribution and recovery of *Ancylastrum* spp. in the lake. Since the lake's refilling in 2017 prevented a snorkelling survey from reaching the previous known locations, a new survey method was proposed, allowing for greater efficiency in survey footprint while reducing person-hours and associated costs. Application of this method resulted in confirmation of the recovery of the

Plate 1. Recovered transect tiles being processed

A. irvinae population and the location of an *A. cumingianus* population, and led to the first confirmed sighting of live *B. tumida* since the lake level had been raised by damming (Smith 2006). As a result, the latter half of the monitoring was directed toward investigating the *A. cumingianus* and *B. tumida* populations.

Method

A novel method to determine the presence of freshwater limpets in *yingina*/Great Lake was devised by Kevin Macfarlane in mid-2021, using terracotta roofing tiles as the substrate. Roofing tiles were selected based on their structural stability (therefore reusable), weight (stability on substrate), inert composition (containing no lime/cement) and cost-efficiency. The tiles were sourced from tip shops, cleaned (by scrubbing with detergent), rinsed and thoroughly dried prior to use.

A total of 31 transects were constructed over the course of this study. Each transect consisted of a series of five roof tiles connected to a rope riser attached to a polystyrene buoy to mark deployment location. The tiles were drilled in one corner and threaded on the transect line using paracord braided twine, each separated by a minimum of 1 m to allow for easy deployment, retrieval, and individual manipulation (Plate 1). The study, conducted between December 2021 and June 2022, required two people working from a boat to deploy and recover the transects.

Transects were placed at depths of 2–10 m, originally located at confirmed *A. irvinae* sites to determine the suitability of the new method for limpet studies. Previously unvisited locations were avoided to prevent confounding negative limpet colonisation of the tiles with true limpet absence. Following confirmation that *Ancylastrum* spp. used the tiles, poorly performing transects (those not colonised for two consecutive sampling events, or with only low limpet counts) were either relocated to new sites or consolidated with others at positive locations to improve detectability at sites

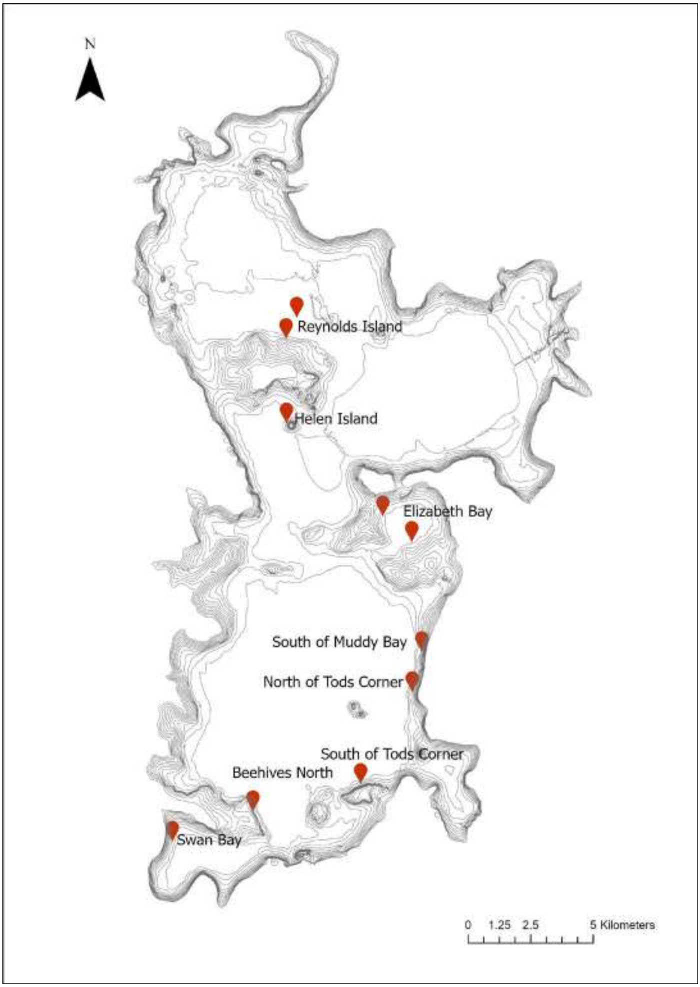

Figure 1. Locations of transect deployment at *yingina*/Great Lake

of interest.

The survey design was flexible, initially including two transects deployed at each of six sites. The number of replicates per site was later increased, although variable, with a maximum of 10 located at one site. In total, eight sites were investigated during the study (Figure 1), some only for two events, before finally being consolidated to three sites to improve detection of the two threatened species at these locations. Monitoring surveys were undertaken periodically, based on windows of opportunity. In total, 10 monitoring surveys were undertaken, one of which was conducted over two days, three days apart.

Following collection, specimens of the three species of interest were provided to Karen Richards for housing and further research; however, a combination of snail parasites (mollusc leeches, possibly of the family Glossiphoniidae, and worms) and predators (planaria) in the tanks resulted in death of most individuals. Similarly, the Planorbidae *Glyptophysa* (*Glyptophysa*) *novaehollandica* (Bowdich, 1822) obtained were also found to host these parasites. Several of the molluscs and the associated parasites were preserved for future study. In addition, specimens of *A. irvinae*, *A. cumingianus* and *B. tumida* were retained for eDNA reference material, and to complete the taxonomic description of *B. tumida*, which is presently limited to shell and radular features.

Results

Site details, including location, number of transects deployed per monitoring event, and sampling dates are presented in Table 1.

Colonisation of tiles by *A. irvinae* was rapid; individuals were detected on five transects at four locations on the first monitoring event, one week after transect deployment (Plate 2a). Similarly, *A. cumingianus* was quick to populate the tiles, being recorded for the first time on the second monitoring event in southern *yingina*/Great Lake, three weeks post-deployment, although the number of individuals was low (Plate 2b). Overall, this species' presence remained restricted to three sites. The target mollusc count per monitoring event is presented in Table 2. *A. irvinae* was the most frequently encountered

Table 1. Number and location of transects monitored per survey

Location & no. transects	22/12/2021	6/01/2022	2/02/2022	4/02/2022	11/02/2022	22/02/2022	2/03/2022	22/03/2022	13/05/2022	16/05/2022	21/06/2022
Beehives North	2	2	2	3	3						
South of Tods Corner	2	2	3	6	8	5	5	5		4	4
North of Tods Corner	2	2									
South of Muddy Island	2	2									
Elizabeth Bay					7	7	7	7	7	7	7
NW shore of Helen Island	2	2	2	3	3						
North of Reynolds Island	2	4	4	10	10	10	10	10		9	9
Swan Bay off Dud Bay		2	4	1							

Table 2. Mollusc species recorded per monitoring event (installation date 15/12/21; *denotes a monitoring event completed across a 4-day period)

Survey date	22/12/2021	6/01/2022	2/02/2022	4/02/2022	11/02/2022	22/02/2022	2/03/2022	22/03/2022	13/05/2022	16/05/2022	21/06/2022
Days between monitoring events	7	15	27	2	7	11	8	20	52*	3 (55)*	36
No. transects deployed	12	16	15	23	31	22	22	22	7	20	20
Total tiles deployed	60	80	75	115	155	110	110	110	35	100	100
No. of sites	6	7	5	5	5	3	3	3	1	3	3
Ancylastrum irvinae	26	40	156	65	129	111	86	152	3	84	45
Ancylastrum cumingianus	2	0	0	0	2	4	1	5	0	0	0
Beddomeia tumida	0	0	3	2	1	0	0	9	0	0	4

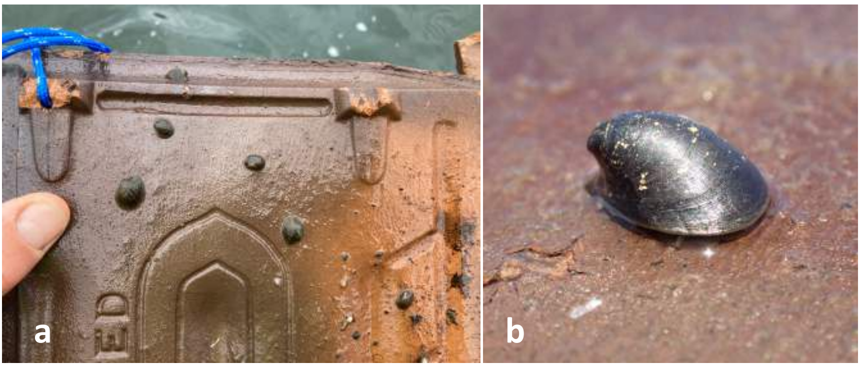

Plate 2. (a) *Ancylastrum irvinae*, and (b) *A. cumingianus* on tiles

species, occupying multiple tiles at numerous locations on each survey. The presence of *A. cumingianus*, however, was more sporadic (recorded on only five of the 10 occasions) and limited to two sites, in the south at Beehives north and at the northernmost site north of Reynolds Island.

The tateid snail *B. tumida* was first observed on 2 February, two months after the original transect deployment (Plate 3), when three individuals were found occupying a single tile. The species detection rate remained low throughout the study. *B. tumida* was only recorded sporadically, in five of the 10 survey events, present on only 1–2 tiles on 1–2

Plate 3. *Beddomeia tumida* present on tile

Plate 4. *Ancylastrum* sp. egg capsule adhered to tile

transects, at a single site. The average number per positive event was 3.8, with nine specimens the highest number recorded on any occasion. The location where *B. tumida* was confirmed is the northernmost site, at the approximate collection locality of the original type specimen, prior to dam construction.

Tiles were also used as a breeding substrate, with *Ancylastrum* egg capsules deposited on flat surfaces 28 days after original deployment (Plate 4). While significant numbers of *Ancylastrum* egg masses were observed on tiles across the study, total numbers were not recorded, and given the similarity in structure of the two species' egg masses, it was not possible to determine the species responsible. Several other eggs and egg masses were also deposited on the tiles; *G.* (*Glyptophysa*) *novaehollandica* egg capsules were most frequently encountered, with planaria and *Paranaspides* eggs occasionally observed. Despite the presence of adult *B. tumida*, no recognisable *Beddomeia* egg capsules were recorded, neither on tiles nor on benthic concretions (laterite with basalt fragments cemented by iron oxide) dredged from the lakebed. Eggs of the native fish *Paragalaxias* were deposited on a tile early during the monitoring; however, this occurred only once.

Discussion

Deployment of roofing tiles as a sampling substrate proved to be both an effective and efficient means of detecting some of the aquatic mollusc fauna occupying *yingina*/Great Lake. The advantages of using tiles as a biomonitoring device include cost-efficiency, stability, weight and ease of deployment. Such a technique reduces reliance on water-based methods such as snorkelling or SCUBA diving, and the need for specialist operators (divers). Use of artificial substrates also increases the number of sites able to be monitored, with additional benefits including minimisation of specimen collection, thus reducing the need for sample preservation, sorting and identification; importantly, it reduces the impact on bycatch, with live animals returned to the habitat following recording. The method also provides opportunities to record species' presence, and aspects of their behaviour and biology at depth, something previously unattainable in *yingina*/Great Lake without the use of divers specifically targeting these species.

The technique was particularly useful for targeting *Ancylastrum* species, and finding both the limpets and egg masses present within a week of transect deployment was surprising. The immediate colonisation of the new habitat by *Ancylastrum* was unexpected, given the limited time available for periphyton to accumulate. While both *Ancylastrum* species were found to use the tiles, *A. cumingianus* was only detected at two locations. Previous captive rearing did indicate some behavioural differences between the species. *A. cumingianus* is apparently more sensitive to light, retreating beneath shelter in bright conditions, while also showing a preference for woody substrate over rocks (Richards et al. 2018). Such behaviour may explain the discrepancy in the species detection and/or colonisation of tiles, although some other factor might be responsible. Monitoring of tiles across the summer also confirmed the pattern of egg capsule deposition recorded in captive rearing experiments (Richards et al. 2018), with the number and size of egg masses reducing over time.

Unexpectedly, the method detected *B. tumida*, confirming the species' extant status for the first time since damming of the lake. Observing live *B. tumida* specimens provided opportunity to document some aspects of its biology, such as age class structure, with a mixed population of adults and juveniles indicating a viable breeding population is present. The specimens also allowed for observation of important taxonomic attributes of the species' head-foot and pallial cavity, including the extent of pigmentation on the head-foot, antennae, eye and eyestalk, and the presence of a pallial tentacle; however, dissection will be required to complete the taxonomic description. The specimens obtained also revealed the unexpected presence of mollusc parasites, previously undocumented for Great Lake mollusca and requiring future research.

Lack of detection elsewhere in the lake suggests *B. tumida* has a restricted distribution, but placement of transects in other locations may yet find evidence of further populations. Unfortunately, no *B. tumida* egg capsules were deposited on the tiles during the study. It is hoped, however, that suitable conditions for egg deposition might be created on the tiles left *in situ* and undisturbed over the 2022 winter–spring period.

While useful as a monitoring tool for *A. cumingianus*, *A. irvinae* and *B. tumida*, the method is of limited use in detecting other *yingina*/Great Lake mollusc fauna, such as those using alternate habitats or with different biology. For example, no benthic Glacidorbiidae species that occupy deep sediment were recorded. Similarly, the presence of several undescribed micro-molluscs, originally collected in 2016 using alternative sampling techniques, went unobserved, although this could be due to their small size or a limited foot tenacity as tiles were retrieved through the water column. However, the tiles did offer suitable substrate for some other lake inhabitants, allowing new observations of planaria, crustaceans and galaxiids in deeper water to be made (e.g., egg deposition by *Glyptophysa*, *Paranaspides* and *Paragalaxias*), thus increasing our understanding of these species' ecological requirements. Importantly, deployment of tiles provided the first record of the native fish *Paragalaxias* breeding at depth, suggesting that the species may use a greater area of *yingina*/ Great Lake for breeding than previously considered likely (Hardie et al. 2011; Freeman 2019 a, 2019b). A similar case can be made for *P. lacustris*, the egg capsules of which were also recorded at depth, albeit sporadically and in low numbers. As such, this method, along with others such as using wood as artificial substrates and deployment of trays of sediment, deserves merit and may offer many potential future research opportunities in this and other lentic systems.

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Goose-necked Barnacles attached to Royal Penguins at Macquarie Island

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While stationed on Macquarie Island in 1968, the author's main duty was continuing the long-term life history studies of Dr Robert Carrick of the Royal Penguin, Southern Elephant Seal and Wandering Albatross. This was the 12th year of the Royal Penguin research where one of the primary duties was to weigh all adult birds coming ashore to breed, from late September through October.

The breeding chronology of the Royal Penguin is highly gender synchronised. Breeding males begin to arrive in late September, followed by females a week or so later and younger non-breeding age classes thereafter. Since completing their annual moult in April, these birds would have been continuously at sea for 4 to 5 months.

It was during this weighing process that Goose-neck Barnacles (*Lepas australis*, Darwin, 1851) were discovered attached to seven penguins arriving ashore between 3 October and 11 October 1967. Early October is primarily the time when breeding female Royal Penguins are returning en masse to Macquarie, to commence their breeding season. In six cases, these barnacles were attached to the bird's mid-riff (mid-central breast feathers) with one barnacle attached to a tail feather. No photos were taken of barnacles in situ, but specimens were collected and recently photographed by the author. All these specimens, and those found attached to Southern Elephant Seals, have now been sent to the Tasmanian Museum and Art Gallery in Hobart.

In addition to the above collections, a single bird feather, believed to be a primary wing feather, was found washed ashore with many small gooseneck barnacles attached to it (Plate 1).

Four of the seven collections were of single barnacles (Plate 2) and three were of clusters, where 1–3 much smaller auxiliary barnacles (Plate 3) were attached to the peduncle of the barnacle directly attached to the penguin. The size of the primary barnacle's capitulum ranged from 8 to 25 mm (mean = 15.6 mm).

Little information is known about the southern distribution of *Lepas australis*, or the foraging range of Royal Penguins, from Macquarie Island. At 54°40'S, this island almost straddles the Antarctic convergence and on occasion, this cold water current can completely engulf the island during the winter months. How this current might impact the range of

Plate 1. Barnacle attached to a feather (largest, capitulum length 5 mm)

Plate 2. Single barnacle – capitulum length approx. 22 mm

Plate 3. Barnacle cluster (largest, capitulum length approx. 8 mm)

these species is unknown. It is believed that a mass die-off of lanternfish in 1967 was likely caused by this process (Merilees 1984).

A literature search revealed that *Lepas australis* has been found attached to at least five other penguin species. This list includes the Snares (Horning 1982), Northern Rockhopper (Reisinger & Bester 2010), Macaroni (Barnes et al. 2004), King (Vanstreels et al. 2012) and Magellanic (Vanstreels et al. 2012) penguins. This note adds a sixth species to the list, the Royal Penguin, endemic to Macquarie Island.

Goose-necked Barnacles are opportunistic hitchhikers, attaching themselves to just about anything that floats, animate and inanimate. Among the former, whales, dolphins, elephant and fur seals, manatees, crocodiles, sea turtles, sea snakes, fish and isopods are documented as hosts (Vanstreels et al. 2012). Also at Macquarie Island, Southern Elephant Seals are regularly encountered encrusted often by many thousands of these barnacles.

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Ongoing monitoring of Flame Robin (*Petroica phoenicea*) in June 2022 in south-east Tasmania

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Introduction

Els Wakefield and Bill Wakefield surveyed six transects in south-east Tasmania between April and July from 2009 to 2014 to monitor Scarlet Robin (*Petroica boodang*) and Flame Robin (*P. phoenicea*) populations (Wakefield & Wakefield 2016). These surveys have been repeated on the same routes in June 2020 and 2021, June being a month when robins had been present on all routes during the previous years of sampling (Wakefield & Vaughan 2021). There were significant differences in Flame Robin numbers between the initial surveys and the 2020–21 efforts. In 2022, Els Wakefield repeated these surveys to increase recent data and contribute to future baseline monitoring.

Whilst Flame Robins and Scarlet Robins were counted, the primary focus was to enumerate Flame Robins. This is because Scarlet Robins tend to join Flame Robins in small numbers as Flame Robins flock during the colder months. This facilitates population counts of both species before they disperse during warmer months, but more predictive inference can be made about the Flame Robins' movements as these respond directly to biological and environmental cues.

Methods

Field methods

The six routes were located around Blackbrush, Brown Mountain, Bruny Island, Runnymede, Tasman Peninsula and Tooms Lake. Each was surveyed on separate days, using the same design as previously published (Wakefield & Vaughan 2020).

Analytical methods

All data visualisation was performed in R Studio (R Core Team 2021). Flame Robin numbers were calculated along all routes travelled in June 2022. The number of individuals observed was also generated for June data of all previous years sampled, to compare counts across years.

Results

Flame Robins were most commonly observed on the Bruny Island and Runnymede routes (Figure 1). This was consistent with results in 2021 (Wakefield & Vaughan 2021). While there was substantial variation in numbers encountered across routes, at least 30 individuals were encountered on each route (Figure 1). Counts in 2022 were consistently approximately half those observed in 2010, and similar to those observed in 2020 and 2021 (Figure 2).

Discussion

There are several possible causes for different counts across years, including environmental factors, overall population change, or site selection over time. Without wider and more consistent sampling it is impossible to determine the most likely cause of this pattern. It is still valuable to investigate these causes, as the decadal differences in counts are substantial. Reassuringly, fluctuations in counts over the last three years have been minimal, suggesting that population numbers have been stable in recent times. This does not necessarily mean that Flame Robins are unworthy of conservation concern, especially given local declines in native birds in agricultural habitats favoured by the species (Bain et al. 2020). Rather, it indicates the value of ongoing monitoring to validate apparent population trends, as we present here.

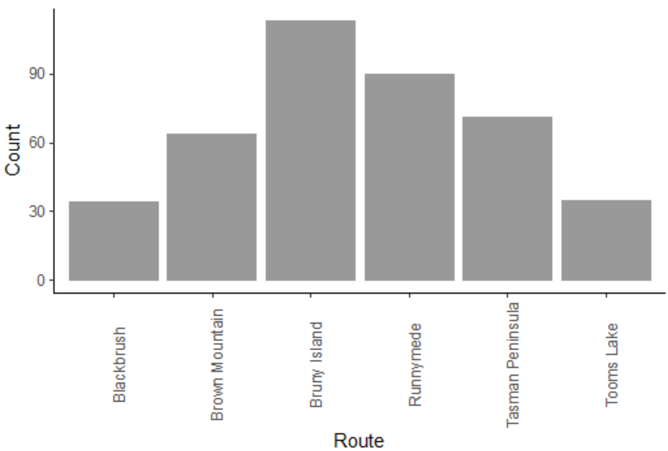

Figure 1. Frequency of Flame Robins (*Petroica phoenicea*) in June 2022 along six transects in Tasmania, Australia

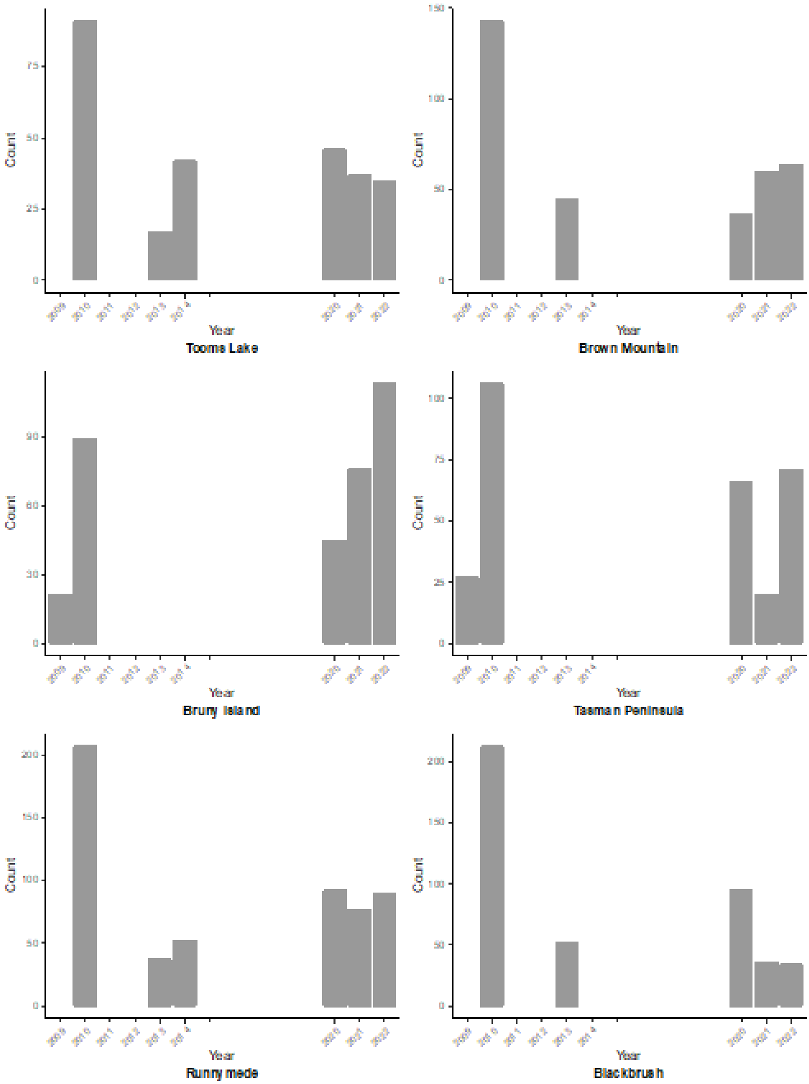

Figure 2. Frequency of Flame Robins (*Petroica phoenicea*) in June (2009–22) along six transects in Tasmania, Australia. The years 2015–19 were not sampled.

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The bald-headed flies of Chauncy Vale, and other personal *bêtes noires*

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If you are a regular reader of *The Tasmanian Naturalist*, you will be well aware that Tasmania is home to some quite remarkable creatures, and that I'm one of those people who has made it a personal quest to get to know some of them. Typically, contributors to this journal report on their special discoveries and observations. But here I'd like to shine a light on some of the ones that got away – all fascinating creatures in their own right, but all still eluding me. I find their evasiveness both galling and enthralling. They are my personal bugbears, my *bêtes noires*. Though mine bear the hallmarks of my own idiosyncrasies – each is a species of true fly (order Diptera) – I hope that what follows will resonate with other naturalists on their own quests.

They Found a Cave is the no-nonsense title of a once widely read children's book by Tasmanian author Nan Chauncy. Nan and her husband Anton lived for many years in a little cottage in a side-valley of the Jordan River, north of Brighton, that now bears her name, Chauncy Vale. The Vale, and more particularly the other-worldly overhangs and caves in the golden sandstone cliffs that flank the vale's southern bounds, provided both the inspiration and the setting for her 1958 book. The caves are deep, shady recesses in a Triassic sandstone cliff line, whose features have been sculpted and smoothed by wind and water over thousands of years. The passage of wombats, wallabies and possums, whose footprints decorate the sandy floors of the caves, may also have contributed to their gradual expansion; and presumably *lutruwita*'s First Peoples would have long made use of the caves too, or at the very least afforded them some spiritual significance. In 1988 Nan's family bequeathed the valley to the local council on the condition that it continue to be run as a wildlife sanctuary, as it had been since 1946.

What's all this got to do with flies? Well, it turns out that Chauncy Vale is currently the only known locality for the first of my *bêtes noires*, the aberrant bald-headed fly (*Clesthentia aberrans*) (Plate 1), and those caves play an ongoing part in this story. Bald-headed flies (that's my translation of the family name, Apsilocephalidae) are an enigmatic group of rather small, stocky flies, related to the bee-flies (family Bombyliidae) and

Plate 1. 'Aberrant bald-headed fly', *Clesthentia aberrans*, body length 5 mm, one of G.H. Hardy's specimens collected at Mangalore, 7 Nov 1914, and still glued to its original card (TMAG F3713)

window-flies (family Scenopinidae). The first two species in the family were each described, independently, in 1914, one in the western United States, the other based on specimens found on the other side of the planet at Mangalore, close to Chauncy Vale. The two fly species were only united in their own family in 1991, at which time a further Tasmanian species, which I shall call the Nunamara bald-headed fly (*Clesthentia crassioccipitis*), was added, based on a single female collected east of Launceston. A close relative of the American species was described from the Baltic coast of Poland in 1967, while another family member was described from New Zealand in 2008. The apparently disjunct global distribution of today's five known species is considered relictual, since fossils of bald-headed flies have been found in 20-million-year-old shale in Colorado and in 100-million-year-old amber in Myanmar, suggesting that they were once widespread globally.

Arthur White, a resident of Mangalore in the early years of the 20th century, had a passion for entomology and especially for flies. I don't know what he did for a living, but he devoted much of his spare time to studying the local fly fauna, describing many Tasmanian and Australian species as new to science. It was he who first recognised and described our local bald-headed flies. In his Royal Society of Tasmania paper (White 1914, p. 46), he wrote: 'This species occurs commonly on the windows of my house at Mangalore, between September 20 and December 15. I have not met with it elsewhere.' Perhaps that was why he gave it a specific name that translates as 'aberrant'. The association with houses, and windows, has suggested to contemporary entomologists that the larvae of bald-headed flies might possibly feed on household insects such as carpet beetles or their remains – which is what members of the related window-fly family do (that family taking its name from the usual 'habitat' of the recently emerged adults). In 1919 (the year of White's death), local entomologist George Hardy, who had until recently been the Assistant Curator at the Tasmanian Museum, published an update on Tasmania's bald-headed flies (Hardy 1919) in which he noted that the species had additionally been found at Hobart, Mount Wellington and Dunalley. This suggests that it's not a particularly rare fly – or at least wasn't so a hundred years ago. But the trail has since gone thoroughly cold, and no further specimens have come to light – except at Chauncy Vale. Fast-forward to the 1990s and a visit to the Vale by David Yeates, one of Australia's leading fly experts and now head of the Australian National Insect Collection in Canberra. Working on the carpet-beetle theory, David recently related to me how he checked out the windowsills inside the sanctuary's field studies centre situated on the floor of the valley. And bingo! Bald-headed flies, their dried husks accumulating on the sills alongside blowflies and other insects that had spent their last few hours of life battering their heads against the window in vain attempts to escape into the wide outdoors.

The story doesn't end there: on David's next visit, the building had been renovated and was much more insect-proof as a consequence. This time, no bald-headed flies on the windowsills. But David reasoned that buildings couldn't have always been the bald-headed flies' preferred habitat over the 100 million or more years of their existence, and that the natural equivalent might be those famous sandstone caves, where dead insects might also accumulate on the dry, sandy floors of the overhangs. So, he went looking for bald-headed fly larvae, sifting large quantities of sand on one winter visit – but drew a blank. He revisited several times in summer, too, sweeping the caves for adult flies – and still drew a blank.

Round about the time that David was not finding bald-headed flies, I made my first visit to Chauncy Vale. The occasion, on a fine December day, was our family's first excursion with the Tasmanian Field Naturalists Club, not long after we had settled in Tasmania. With toddlers in tow, it was all we could do to clamber up to the nearest of the caves, following the rough path that climbs steeply from the valley floor, initially through thickets of wallaby-browsed silver wattle and then through groves of she-oak interspersed with more open areas of kangaroo grass, saggs, flax-lilies and fireweed. There were unfamiliar plants, animals, fungi and fossicking naturalists wherever we looked, and it was all rather overwhelming for us newbies. But the naturalists, eccentric to the last, welcomed us into their world and I have been a member of the Club ever since. It's a safe space where we can celebrate our eccentricities and feel comfortable in our own very personal and often rather idiosyncratic relationships with the natural world.

In later years, since becoming aware of bald-headed flies (some of Hardy's specimens from Mangalore still reside in the Tasmanian Museum collections), I have returned to Chauncy Vale on several occasions in December with the explicit aim of finding these enigmatic creatures. Like David, I have inspected the array of dead insects on the windowsills at the field studies building, and like David, I have (under permit) swept my net through as many of the caves as I could safely reach and have sifted their sands. It will not surprise you to learn that through all these efforts I have not yet turned up even a single bald-headed fly. But as is the way with these quests, all is not lost and every cloud has a silver lining. I did find many other insects in those caves. Presumably, they were aestivating – seeking out a cool, shady spot so that they could pass the worst of the hot weather in a state of torpor. One cave yielded a strange fly that had me stumped for a long time, until I was eventually able to identify it as a rather unusual species of bee-fly – the best I can do by way of translation is to call it the little zaclava bee-fly (*Zaclava minor*). In all their writings on Tasmanian flies, neither White nor Hardy mentioned finding anything like this fly in the area; indeed, the species was described only in 1929. It seems that my find, nearly a century later, was a first for Tasmania. Every visit to the Vale is a delight. The valley echoes with birdsong; the ephemeral creek in the valley floor harbours permanent, shady pools where endemic freshwater prawns and water-penny beetles lurk; and insect life abounds – just no bald-headed flies, yet.

There is another striking fly that is particularly deserving of the *bête noire* moniker, in part because it is genuinely a dark beast, unlike all other local members of its family. Stiletto-flies (family Therevidae) – so-named because of their pointy feet, apparently – are found worldwide, often in dry, sandy country where their wiry larvae snake through the sand in pursuit of invertebrate prey, not unlike scaled-down versions

Plate 2. 'Black-beast stiletto-fly', *Johnmannia tasmanica*, body length 12 mm, one of Chris Spencer's specimens collected at Collinsvale, 6 Dec 2005 (TMAG F108445)

of the giant sandworms in Frank Herbert's *Dune* trilogy. But in Australia, one particular lineage of stiletto-flies has moved well away from this habitat: their larvae mostly tunnel into rotten wood instead. The adults, too, look very different from the squat, densely brown- or grey-haired typical stiletto-flies: they are often almost hairless and brightly patterned, both on the body and on the wings, and many mimic various predatory or parasitic wasps in both their looks and their movements – for instance, waving their banded front legs in the air as they walk over logs, as though these appendages were the twitching antennae of an ichneumon wasp. Nearly all members of this lineage are to be found in dry woodlands; but my *bête noire*, which I will dub the black-beast stiletto-fly (*Johnmannia tasmanica*) (Plate 2), shuns the dry country and inhabits rainforest and wet eucalypt forest instead, both in Tasmania and in the south-east corner of the Australian mainland. I first became aware of its existence when I was undertaking an initial taxonomic sort of the pinned flies in the Museum collections and spotted an unusual-looking fly that had been grouped with the soldierflies (family Stratiomyidae). It was shiny blue-black all over, with darkened wings and a hunched appearance, and with a pointy, downturned abdomen a bit like that of a spider-hunting wasp. It keyed out as a stiletto-fly, but it just looked all wrong, so I sent a photo to the national expert on this group, Christine Lambkin, who confirmed that it was indeed a rare member of this family, one in which only half a dozen or so specimens were known, all (like the one in my photo) female. Our specimen had been collected many years ago in Mountain River, just to the west of *kunanyi*/Mount Wellington. I suspect it had been collected and brought to the Museum out of general curiosity, most likely from someone's windowsill, since the collector's name on the label was not that of a known entomologist. I learnt of others having been found in trap samples at my old stomping grounds at Warra, further to the west; and then two more appeared among entomologist Chris Spencer's donated collection from Collinsvale, just to the north of *kunanyi*/Mount Wellington – also mislabelled as soldierflies and also, I believe, found inside a house. All known specimens had been collected in December.

Armed with these insights into the species' range, habitat and flight period, I have made determined efforts over several years to visit known and likely haunts. I also set up traps in similar habitat, such as in the Tarkine rainforests. But all – so far – to no avail. The black-beast stiletto-fly still eludes me, and I'm taking it personally. I feel as though it is taunting me, questioning my abilities as a field entomologist. In the schoolground of my distant youth, in games of chase we would chant, 'you can't catch me for a toffee flea'. I never knew what a toffee flea was, but perhaps it's rather like a black-beast stiletto-fly. On the plus side, I found plenty of other creatures of interest wherever I went. And I think that's the lesson here: with apologies to the Rolling Stones, you can't always get what you want, but if you try sometimes,

Plate 3. 'Bare-bellied hoverfly' *Deineches nudiventris*, body length 13 mm, collected by Tania Kay at Cygnet, Feb 2005 (TMAG F9785)

you might find you get plenty of other stuff instead, much of it equally rare and with the added bonus that you weren't expecting it. Thus, my trips to Collinsvale have taken me into the enchanting Myrtle Forest, where I found all sorts of rainforest-associated insects, including the beautiful leprea brown butterfly, which has the distinction of being the sole representative of its genus, as well as being endemic to Tasmania. My Tarkine trips have also been rewarding, not just for the insects and velvetworms but for the joy and awe of spending time in the middle of that wild and remote landscape.

And then there is Tasmania's largest hoverfly, which I shall dub the bare-bellied hoverfly (*Deineches nudiventris*) (Plate 3). This impressive, largely orange-coloured fly is hard to overlook, yet so far it has been completely overlooked by yours truly. Admittedly it appears to be rare, but it puts in a regular appearance on social media, usually with a 'what's this amazing fly?' tagline or similar. We have several specimens in the Museum collections donated by interested members of the public from around Hobart, some found inside suburban houses. Clearly, I need to spend more time at home, peering out the window, or better still, staring *at* the window and examining windowsills. I even saw a post about one of these lovely flies spotted hanging around a heap of woodchips left by council workers in Taroona Park, a couple of hundred metres from my home and on one of my regular walking routes. It would have been a female attracted there by the smell of fermenting sapwood, I suspect, since this would approximate what I think is the usual larval habitat in the trunks of old, sickly eucalypts. Whenever I spot a heap of woodchips or bark mulch, I do a bit of hovering around myself, hoping to catch sight of a bare-bellied hoverfly. But I never have.

In a similar vein, there's the wavy fernfly (*Teratomyza undulata*) (Plate 4). Fernflies (family Teratomyzidae) are small, narrow-bodied flies with elongate wings often mottled in contrasting shades of slaty grey and white, though some have clear wings. The family as a whole is confined to the Oriental region, South America and Australasia, with several species occurring in the wet forests along Australia's eastern seaboard. They supposedly hang around on the underside of fern fronds, on which their larvae feed. Tasmania is a very ferny place, and you would have thought that the island would be thick with fernflies. Yet the only evidence known to me of the wavy fernfly's occurrence in Tasmania comprises the photos taken by Tony Daley and Kristi Ellingsen featured in their online *Field Guide to the Insects of Tasmania* – all taken in suburban Hobart – and similar local sightings by Lynne Forster. Tony informs me that he has also seen the species in Geeveston. For my part, I have diligently swept my net along the ferny fringes of thousands of metres of Tasmanian trackways, from the slopes of *kunanyi*/Mount Wellington to the Tarkine and many points in between; I have always drawn a complete blank. Clearly I have been overthinking this and should refocus my efforts closer to home.

Plate 4. 'Wavy fernfly' *Teratomyza undulata*, body length 3 mm, photographed by Tony Daley in Sandy Bay, Hobart, some years back

It's made me wonder, what would I do if I found my *bêtes noires*? I would certainly count my good fortune; I might even jump for joy. I would imbue the discoveries with layers of meaning and commit them to memory. But what then? I know from previous finds that much of the pleasure I derive from bug-hunting is in the eccentricity and audacity of the quest, and how that plays out over days or years, rather than in the finding. And I appreciate that if you yearn for something too much, you're setting yourself up for disappointment. That tenet of Eastern philosophy could have been written for naturalists, and for a younger version of myself. From the point of view of our own evolution, maybe hunting unusual bugs is my way of playing out deep instincts to do with hunting and gathering: I certainly find the thrill of the chase thoroughly rewarding, addictive even. In any event, I'm unlikely to stop anytime soon as there will always be plenty more quests, more unusual bugs, to take the place of those already consigned to pleasant memory.

Acknowledgements

Thanks to Tony Daley for sharing his photo of the wavy fernfly, and to David Yeates for sharing his experiences of hunting aberrant bald-headed flies at Chauncy Vale. Thanks, too, to the reviewers of an earlier draft of this article.

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A new adult eucalypt food plant, and western Bass Strait distribution records, for the golden stag beetle *Lamprima aurata* (Scarabaeoidea: Lucanidae) in Tasmania

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New adult food plant

The trophic flexibility of both larval and adult *Lamprima aurata* in Tasmania is well documented (Fearn 1996, 2015, 2016, 2017, 2020, 2021; Fearn & Maynard 2018) with a range of native and introduced plants, shrubs and trees utilised. Adult male *L. aurata* sever shoot tips on host plants with their mandibles to initiate a sap flow where both sexes feed and copulation occurs. The most common adult food plants in Tasmania are eucalypts, particularly saplings and young trees. Four species have been documented so far – *Eucalyptus viminalis*, *E. globulus*, *E. ovata* and *E. regnans*.

On 28 December 2021 at Watch Bay, Hunter Island in western Bass Strait (centred on –40.491129, 144.734679), the second author discovered a mating pair of *L. aurata* on sapling, post-fire regrowth of *Eucalyptus obliqua* L'Her (Plates 1 and 2).

The terminal shoot of the stem that the beetles were on had been cut off in the usual way (see references cited above) and the female was actively lapping up sap when first spotted. Both beetles were collected as vouchers (QVM.2022.12.2900 [male] and 2901) and lodged in the entomology collection of the Queen Victoria Museum and Art Gallery (QVMAG).

Western Bass Strait records for *Lamprima aurata*

Lamprima aurata is widespread throughout the warmer, drier portions of eastern and coastal Tasmania including eastern Bass Strait (Fearn 1996; Reid et al. 2018; ALA 2022). Densities vary widely, apparently based on availability of larval food sources. *L. aurata* readily exploits anthropogenic disturbance, particularly agricultural and forestry activities that clear land and leave large volumes of stumps and logs behind. In some situations, many thousands of beetles can be found at a location for several years until larval food sources are depleted (Fearn 1996).

Plate 1. Approximately 1 m tall sapling regrowth of *Eucalyptus obliqua* on Hunter Island, western Bass Strait (photograph David Maynard)

Plate 2. Mating pair (male on top) of *Lamprima aurata* on sapling *Eucalyptus obliqua* on Hunter Island. Note severed terminal shoot directly in front of female foreleg. (Photograph David Maynard)

Lamprima aurata appears to be absent from undisturbed closed forests with shaded substrates and hence is unrecorded from western Tasmania (Fearn & Maynard 2018; Reid et al. 2018). However, low collecting effort rather than true absence may explain the lack of records from coastal and agricultural habitats in the west of the state. Western specimens in the QVMAG collection are from Wiltshire, Trowutta, Three Hummock Island, The Nut at Stanley (Fearn & Maynard 2018), and now from Hunter Island.

Two adult males have been collected on Three Hummock Island in western Bass Strait by the second author (Plate 3). The first (QVM.2022.12.2898) was discovered on a specimen of *Correa backhouseana* Hook. var. *backhouseana* at Rape Bay on 2 January 2016 (centred on –40.39649, 144.91573) but no evidence of feeding could be found. The second (QVM.2022.12.2899) was collected on a flowering *Leptospermum* shrub inland of East Telegraph on 30 December 2021 (centred on –40.45038, 144.91921) and again, no evidence of feeding was discovered.

These records appear to be the first of *L. aurata* from Hunter and Three Hummock Islands in western Bass Strait.

It appears remarkable that there are no documented records of *Lamprima aurata* from King Island (Lea 1908; ALA

Plate 3. Adult male *Lamprima aurata* (QVM.2022.12.2898) on *Correa backhouseana* Hook. var. *backhouseana*, Three Hummock Island, western Bass Strait (photograph David Maynard)

2022). A photograph of a specimen in McQuillan (2003) was not from King Island and was part of a selection of common Tasmanian woodland beetles (P. McQuillan pers. comm.). Between 29 January and 6 February 2019, the authors conducted an entomological survey on King Island. In spite of examining hundreds of logs and stumps and collecting thousands of insects off vegetation of all types, no evidence of *L. aurata* larval or adult activity on the island was discovered. If *L. aurata* is absent from King Island it implies either that it never colonised the island before its separation from the mainland and Tasmania some 11,000–12,000 years BP (Lambeck & Chappell 2001), or that it became extinct on the island at some point after its isolation. The authors favour the former explanation.

While purely speculative, the many disruptive climatic fluctuations between warm/moist and dry conditions during the Quaternary may have produced habitats surrounding King Island that were unsuitable for *L. aurata* dispersal and colonisation (Cranston & Naumann 1991). Given the species' remarkable adaptability and ability to rapidly colonise areas of anthropogenic disturbance (Fearn 1996; Fearn & Maynard 2018), it would be unlikely that the rapid clearing and burning of forests and woodlands on King Island after European settlement in the mid-19th century (Lloyd 2003) would have disadvantaged an indigenous *L. aurata* population in any way.

Acknowledgements

Thanks to the crew of *Sooty Petrel* for getting the second author to Three Hummock Island, and to Miguel de Salas of the Tasmanian Herbarium for providing host plant identifications.

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Some observations on the life of the blue ant *Diamma bicolor* Westwood, 1835 (Hymenoptera: Tiphiidae)

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Followers of our investigations over the past 16 years have often remarked on the apparent success rate of our invertebrate rearing, amazed at Chris's abilities in this regard. Occasionally though, the question has been asked: do you ever have failures? Well, perhaps it's time to confess; the response to this inquiry is 'yes, of course, frequently'. This is why, at least in part, should you re-read our articles, it is evident that some of the research took years to complete. Chris, never being one to shy away from failures, such as the unforeseen death of a specimen we had been observing, rather took these instances as learning opportunities, trial and error, or points to consider the for next time around. This article, drafted by Chris in 2020, documents two such occasions.

Numerous species of flower wasps (Tiphiidae) occur in Tasmania and provide an ecologically important service to plant communities as pollinators. The family are parasitoids, most members of which target a range of beetle larvae as hosts upon which to rear the young and are active in the spring to summer months coinciding with the life cycle of host species. Adult flower wasps feed on nectar and several of our native orchid species, in particular the bird orchids *Chiloglottis* spp., have evolved uniquely shaped and coloured flowers designed to attract these insects. Some orchids even produce chemical substances which so closely mimic the sex pheromones emitted by the female of the chosen flower wasp species that the male wasps athletically attempt to mate with the flower, instead becoming anointed with a packet of pollen adhered to their head or thorax for their efforts, which they might then carry off to another flower.

Diamma bicolor Westwood, 1835 is arguably the most impressive species of flower wasp found in Tasmania. The female resembles an ant and, as the name suggests, it feeds on nectar. Known as the blue ant or blue bottle, *D. bicolor* (Plate 1) is uncommon over much of the state, being more frequently encountered in drier regions of eastern Tasmania. As is the case across the Greater Hobart area, these wasps were also regular summer visitors to our previous garden at Collinsvale. The metallic blue female is large (up to

Plate 1. Female *Diamma bicolor* on *Bursaria spinosa* blossom

Plate 2a. Unconfirmed *Diamma bicolor* cocoon

Plate 2b. Unconfirmed *Diamma bicolor* pupa

25 mm), flightless and often displays a restless, jerky locomotion, holding her abdomen aloft in an aggressive manner, with sting poised toward the ground, as she searches for prey to become the hapless food source for her larva. Mole crickets (*Gryllotalpa* Leach, 1815) were the preference for *D. bicolor* in our garden and are the recognised larval food source for the species (Grove 2019), although historically, Williams (1919), amongst others, speculated that the species perhaps attacks caraboid larvae, based on the host size and habits of other wasps.

The female *D. bicolor* homes in on the prey by entering potential burrows and excavating the inhabitant, which it subsequently stings to paralyse, then drags the victim off to a previously prepared site wherein she attaches a single egg to it. While to some this may appear gruesome, the act guarantees a continuous food supply for the wasp larva that develops as it devours its still-live cricket host. Though appearing aggressive, these animals do not sting if left alone; however, the sting is painful, and females are capable of stinging multiple times.

After completing the larval phase, the larva constructs a cocoon on the host corpse, within which it pupates and from where the adult wasp emerges, making its way to the surface in late spring to early summer. Unlike the vivid metallic blue female, the male *D. bicolor* is macropterous (having functional wings), is smaller (15 mm), displays a completely different colour (black with white spots) and does not sting. The male is seldom seen, or at least is unrecognised to most as the same species, and therefore goes under-reported.

The females of most Thynninae are highly modified, have poor, if any, eyesight, and are incapable of feeding themselves. They are therefore reliant on the male to provide food either through regurgitation or carrying them to a food source. In contrast, female *D. bicolor* are fossorial and active, have acute vision and require no feeding assistance (Given 1954). *Diamma* feed on the nectar of native shrubs, and it is on the blossom that mating usually occurs; this activity is also put to good use by the plants, as the insects become smeared with pollen, which is transferred to neighbouring blossoms as the wasps continue to feed.

An apparently unusual coupling event was observed in late October 2019. While gardening in the vegie plot one sunny, warm (25 °C) afternoon, Chris inadvertently unearthed a pair of *D. bicolor*, *in copulo*, inside a shallow burrow in the garden bed. This suggests the male could detect pheromones from the emerging female and was so eager to engage that he burrowed to her location. An arboreal *D. bicolor* coupling was recorded in our garden shortly after Chris first noticed a female active on *Bursaria spinosa* blossom, 1.3 m above the ground, on a sunny, hot day in late December 2014. Another was recorded on a sunny, warm day in January 2018; this time the male was seen in flight pursuing a female, and mating took place on *Leptospermum* blossom.

In early March 2019 (11/03/19) Chris unearthed a curious cocoon whilst harvesting produce from a raised vegetable garden (Plate 2a). It was probably positioned approximately 10 cm below the surface prior to disturbance. Given its size and shape (9 × 4 mm), the frequency of female blue ant observations in the garden during the summer months, and lack of knowledge of what other species it might belong to, a pupating *D. bicolor* was suspected to be within; so, as often happened, an investigation ensued. Never someone to be without a collecting container, Chris immediately transferred the cocoon into a large vial along with some substrate around the cocoon to rear out the occupant. Left untouched for several months, on 1 December 2019, out of concern for failure of the specimen, the cocoon was exhumed and opened, revealing a dead wasp pupa in very good condition within (Plate 2b). There were no outward signs to indicate a likely cause of death, so the pupa was preserved in ethanol. To this day, no other such cocoon has been found in the garden.

Several days earlier, on 29 November 2019 at 13:00, Chris had observed movement on the ground near where he was weeding. A female *D. bicolor* in possession of a paralysed mole cricket came into view, the wasp manhandling the prey towards what was later revealed to be a partially concealed burrow located amongst dry grass some 70 cm distant. The progress was slow, however, as the wasp attempted to drag the prospective larval food source headfirst, by antennae, leg and palps across the uneven surface, mostly backwards, but occasionally astride (Plate 3). Whilst paralysed and seemingly immobilised, on several occasions a feeble but ultimately unsuccessful attempt was made by the cricket to move a leg, demonstrating incapacity for co-ordination, as it was

Plate 3. *Diamma bicolor* manipulating mole cricket larval host toward burrow

Plate 4. Mole cricket (*Gryllotalpa* sp.) hosting a *Diamma bicolor* egg (inset)

hauled away. Unbeknown to us, the stinging of a mole cricket by *D. bicolor* had been documented in detail by Hardy (1911).

Though unaware of Hardy's report until later, Chris in a similar fashion experimented with the wasp and prey by moving the cricket a few centimetres away and, when an opportunity arose following its release from the wasp's grasp, observing the reaction. On each occasion, *D. bicolor* would search for the prey in a pattern spreading outwards in expanding sweeps from the last known location until the cricket was relocated. At one point the cricket began to show signs of recovery; however, the wasp immediately commenced stinging the prey, this time in multiple sites between tergites on its abdomen to ensure compliance. Eventually, after Chris tired of this experiment, the wasp was allowed to continue her task. We watched as she excavated a concealed burrow entrance, and then as the mole cricket slowly disappeared down the burrow; the wasp became increasingly agitated by her failed attempts to quickly drag, then later push, the victim into the depths. Finally, after entombing the cricket below ground, the wasp emerged and sealed the burrow entrance with soil and leaf debris. Three hours and 20 minutes had passed since we began observing the female.

Once we were confident that the wasp had completed her task and departed, the site was marked to allow relocation. Two days later the site was excavated, revealing a vacant cricket burrow of approximately 50 cm length descending at a shallow angle to a depth of 35 cm. Not immediately apparent, the paralysed cricket was eventually located inside a sealed cell at a depth of 20 cm, off the side of the main tunnel. The cricket, lying motionless on its back, had a white cigar-shaped egg capsule (3.5 × 1 mm) attached to its abdomen near its hindleg (Plate 4). Although still able to twitch when disturbed, albeit almost imperceptibly, it appeared otherwise incapacitated. The hapless cricket was transferred onto the surface of a soil-filled container, then covered with a lid to maintain moisture and reduce light levels, and the container closed.

Inspections were conducted every second day, the cricket remaining motionless unless disturbed. The experiment appeared to be going well, the eyes of the larva now visible through the egg casing. However, tragedy struck sometime between 20 and 22 December: the egg capsule was gone and there was evidence of 'grazing' on the cricket flesh. At first this seemed a positive sign, but the host was now dead and there was no sign of the larva. A subsequent inspection of the substrate revealed the presence of a sizeable juvenile rove beetle, which had remained unobserved in the soil since the translocation. The experiment was deemed over, notes recorded, and the cricket and soil matrix disposed of.

In hindsight, despite our assumption that the cricket's death was a direct result of rove beetle attack, there remains a degree of uncertainty, a seed of doubt. It is possible that the *D. bicolor* larva was alive, buried in the decaying flesh of the mole cricket; however, this is only speculation as larvae of this group are considered to feed ectoparasitically on body fluids (Salter 1966), so internal feeding is unlikely. The only evidence of attack by the rove beetle are two blurry images taken of the beetle pulling at a leg joint of the cricket. It was a sizeable larva, and the absence of other food sources inside the container suggests that beetle attack remains the most likely explanation.

Several take-home messages arose from this experiment, the most obvious being 'don't assume anything'. A dissection to confirm the presence or absence of the larva within the cricket flesh should have been conducted; at least this would remove the seed of doubt regarding larval presence. The second lesson is: 'Always inspect potential natural substrate prior to housing the target invertebrates.' That was normal practice for Chris; however, this study was *ad hoc* and the speed with which it was carried out overtook our usual scientific approach to invertebrate housing. 'Ensure images are clear, not substandard' before disposing of the subject seems another obvious message, or better still, 'Buy a better camera!' Finally, 'Undertake a literature review early in any study'; if nothing else, it may avoid duplication of effort but can also provide inspiration and confidence in conclusions.

The environment in which our current home in Moonah is located appears not conducive to *D. bicolor*, although one mole cricket was heard earlier this year. Therefore, unfortunately, it is unlikely that I will again have an opportunity to study the fascinating life cycle of this species. Hopefully this report will inspire others to fill in the knowledge gaps, such as the duration of pupation and a confirmation of larval feeding behaviour, or perhaps to take on the challenge of studying many other under-studied invertebrate species.

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First field photographs of the Endangered Schayer's grasshopper *Schayera baiulus* (Erichson, 1842), and confirmation of adult morphology, from a newly discovered population in coastal north-eastern Tasmania

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Introduction

The mystery of Schayer's grasshopper (*Schayera baiulus*) (Erichson, 1842) has intrigued zoologists for decades, with much speculation around habit, preferred habitat and peak seasonal activity. It was described in 1842 (as *Calliptamus baiulus*) by Professor Wilhelm Ferdinand Erichson, the then-curator of invertebrates at the Museum für Naturkunde in Berlin (Driessen et al. 2020). The three female specimens were collected in north-west Tasmania and sent to Erichson by his friend Adolphus Schayer, a sheep-breeding expert at the Woolnorth Station property, then owned by the Van Diemen's Land Company (Threatened Species Section 2006). It took almost 150 years before any further specimens were collected, with a dead male nymph collected by E.J. Zurcher and C.A.B. Gilbert near Rushy Lagoon in far north-east Tasmania in 1988, approximately 270 km from where Schayer's specimens were collected. At roughly the same time, K.H.L. Key collected a live female nymph at Cape Grim in far north-western Tasmania (Key 1991), close to where Schayer's specimens were found. Two of the original specimens collected by Schayer were sent from Berlin to K.H.L. Key in Canberra, who redescribed and illustrated the original material and erected the monotypic genus *Schayera* for Erichson's *Calliptamus baiulus*, considering it to be closely related to the mainland catantopine genera *Apotropis* Bolívar, 1906, *Azelota* Brunner, 1893 and *Perunga* Sjöstedt, 1921 (Driessen et al. 2020; Key 1990).

Subsequent surveys by K.H.L Key and P.B. McQuillan (Key 1991), Tasmanian Museum and Art Gallery (TMAG) and others, in both the north-east and north-west of the state failed to find Schayer's grasshopper for close to 30 years. This meant that only two specimens, both nymphs, had come to light over a period of almost 180 years. This is until 2018, when one of us (SG) found an adult male (now in the TMAG collections, with registration number F96436) while sweep-netting in the dunes behind Lemons Beach, between Petal Point and Cape Portland. This male allowed for the species description to be updated with the first adult male specimen of the species and increased our understanding of its habitat (Driessen et al. 2020).

In October 2021, a flora survey was being conducted by one of us (RF) on the property owned by Woolnorth Renewables at Cape Portland in far north-east Tasmania; this property is described in more detail in Baker et al. (2021) and Grove et al. (2021). During the survey several grasshoppers which fitted the description of Schayer's grasshopper were observed and photographed; subsequently a male and female were collected and delivered to TMAG for confirmation of their identity. These two specimens help to provide more information on the preferred habitat of the species and its period of peak activity; they also provide evidence as to the physical appearance of live adults of the species, as outlined below.

Material and methods

Collecting details and description of habitat. The two new specimens (now in the TMAG collections, with registration number F121064 [male] and F121063 [female]) were collected (by RF) on 21 October 2021 while undertaking a flora monitoring transect in a landward section of the Cape Portland Conservation Area (see Fig. 1 in Grove et al. 2021, where it is labelled 'The Salties'; or Fig. 1 in Baker et al. 2021), at 40.7518°S, 147.9528°E.

The Cape Portland Conservation Area has been fenced off from stock grazing since 2010, although grazing pressure has remained high due to the presence of eastern grey kangaroos (*Macropus giganteus*), Bennett's wallabies (*Notamacropus rufogriseus rufogriseus*) and common wombats (*Vombatus ursinus*). The area in question comprises vegetation classified as coastal grass and herbfields (CGH) under the Tasmanian Vegetation Classification (DPIPWE 2020; Kitchener & Harris 2013). The vegetation consists of grasses, herbs and thick patches of *Lomandra longifolia* with scattered shrubs: *Bursaria spinosa*, *Leucopogon parviflorus*, *Lycium ferocissimum* (introduced) and *Rhagodia candolleana*. The ground cover of the area comprises approximately 30% *Lomandra longifolia*, with the remainder being a mix of grasses, sedges and herbs (Table 1). Several native grasses and sedges were unable to be identified due to grazing pressure leaving no flowering material for positive identification. Plates 1 and 2 show the vegetation in this area.

Some 10–15 putative Schayer's

Table 1. Cape Portland CP1 monitoring transect vascular plant species list

Species	**Common name**
Arctotheca calendula (Introduced)	Capeweed
Bulbine bulbosa	Bulbine lily
Bursaria spinosa	Sweet bursaria
Convolvulus angustissimus	Pink bindweed
Dichondra repens	Kidney weed
Geranium potentilloides	Soft crane's-bill
Holcus lanatus (Introduced)	Yorkshire fog
Hypochaeris glabra (Introduced)	Smooth cats-ear
Kennedia prostrata	Running postman
Leucopogon parviflorus	Coast beard-heath
Lomandra longifolia	Spiky-headed mat-rush
Lycium ferocissimum (Introduced)	Boxthorn
Oxalis perennans	Yellow wood-sorrel
Oxalis rubens	Dune wood-sorrel
Pimelia linifolia	Slender rice-flower
Plantago coronopus	Buck's-horn plantain
Pterostylis sp.	Greenhood orchid
Rhagodia candolleana	Seaberry saltbush
Rumex acetosella (Introduced)	Sheep's sorrel
Spinifex sericeus	Coastal spinifex
Trifolium dubium (Introduced)	Lesser trefoil
Trifolium subterraneum (Introduced)	Subterranean clover
Vicia sativa (Introduced)	Common vetch

grasshoppers were observed along a 50-metre monitoring transect. The grasshoppers were predominantly along the periphery of the *Lomandra longifolia* patches where these abutted grazed, grass-dominated areas. Adult grasshoppers were observed taking flight when disturbed, flying distances of 1–5 m and up to 0.5 m off the ground. The weather on the day was fine, with approximately 20% cloud cover, easterly winds to a maximum of 33 km/hr (average 18 km/hr) and a maximum temperature of 17.6 °C (Bureau of Meteorology observations were drawn from nearby Swan Island, BOM station 092123).

Plate 1. Coastal grass and herbfields on the Cape Portland headland where Schayer's grasshoppers were observed and an adult male and a female were collected

Plate 2. Coastal grass and herbfields on the Cape Portland headland where Schayer's grasshoppers were observed and an adult male and a female were collected

Description of specimens

The live grasshoppers that were later collected were first photographed in the field (Plates 3 and 4) and then against a white background (Plate 5). At 21 mm (front of head to rear of abdomen), the male is significantly smaller and sleeker than the stockier female (30 mm). The sexes also differ in colouration, with the males (over 10 observed) being brightly marked in yellow and olive-green while the females (two observed) were marked in various shades of light to dark brown. The wings of the male are full-length and were observed in flight, whereas those of the female are shortened somewhat, with none observed in flight.

Plate 3. Male Schayer's grasshopper photographed at Cape Portland

Plate 4. Female Schayer's grasshopper photographed at Cape Portland

Plate 5. Male (left) and female (right) Schayer's grasshoppers collected from Cape Portland

Discussion

The habitat and time of year in which the specimens were found provides new information on the species and may assist with future surveys. Key (1991, p. 660) suggested that 'October would probably be the month of choice, because there would be fewer other species about, and because mortality from predation progressively reduces density as the season advances'. The observation of active adults during October supports Key's suggestion and may indicate that the species becomes active in early spring or even late winter; this is further supported by the previously collected nymphs having been collected during early October. The two nymphs and one adult found since 1988 were found in late October at Rushy Lagoon (Key 1990), on 15 November at Cape Grim (Key 1990) and on 9 November at Lemons Beach (Driessen et al. 2020). This is unlike observations of other species in the tribe Catantopini, which, from entries on iNaturalist (2022; sample size = 7,076), peak from January to March.

The habitat in which the specimens were found, coastal grass and herbfields (TASVEG code GHC), occurs across the north coast of Tasmania, on the Furneaux Group of islands, on the Fleurieu Group of islands and on King Island. This habitat is different from that of the three specimens collected since 1988, with one having been collected in coastal dunes (Lemon Beach, Driessen et al. 2020), one in a *Melaleuca ericifolia*, *Lomandra longifolia* and *Poa poiformis* seepage line (Cape Grim, Key 1991) and one on a rocky slope with *Allocasuarina verticillata* (Rushy Lagoon, Key 1991). All records, however, are coastal. With the observed abundance of adult grasshoppers in the coastal grass and herbfields of Cape Portland, future survey efforts may be best focused in early spring and directed towards this vegetation type, particularly where *Lomandra longifolia* dominates.

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Bird and other vertebrate sightings around Pedra Branca and the Mewstone February 2022

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This trip had been planned many months before as an extension of trips in the previous two summers when we had visited either Pedra Branca or the Mewstone. The weather is usually more stable in February and fortunately the last Sunday of the month (27 February) was deemed suitable. Ten of us had booked camping spots and other accommodation at the Southport Motel for an early start and two drove down early on Sunday from Hobart.

We met up with the skipper Dave and his son Albert at the Southport Jetty at 6am. The skies were overcast and the forecast was for 15-knot winds and a 2-metre swell. As the sun's rays lit the water through gaps in the clouds, we headed straight out towards Pedra Branca.

In transit, bird sightings recorded were up to 30 Australasian Gannets (*Morus serrator*), and a White-fronted Tern (*Sterna striata*), 195 Kelp Gulls (*Larus dominicanus*), 25 Silver Gulls

Plate 1. Shy Albatross chicks on rocks of Pedra Branca (photograph Els Wakefield)

(*Chroicocephalus novaehollandiae*), 3,786 Short-tailed Shearwaters (*Puffinus tenuirostris*), 9 Sooty Shearwaters (*Puffinus griseus*), 9 Greater Crested Terns (*Thalasseus bergii*), an unidentified *Pterodroma* species, 9 Shy Albatross (*Thalassarche cauta*), 14 Buller's Albatross (*Thalassarche bulleri),* 5 Common Diving Petrels (*Pelecanoides urinatrix*), 1 Fluttering Shearwater (*Puffinus gavia),* 1 Indian Yellow-nosed Albatross (*Thalassarche carteri*), 2 Grey-backed Storm Petrels (*Garrodia nereis*), 7 White-faced Storm Petrels (*Pelagodroma marina*), 2 Black-faced Cormorants (*Phalacrocorax fuscescens)* and a single Buller's Shearwater (*Ardenna bulleri*). In addition, we recorded 7 Common Dolphins (*Delphinus delphis*) and 2 Australian Fur Seals (*Arctocephalus pusillus doriferus*).

Before arriving at Pedra Branca, we did some close passes of Eddystone Rock and wave-washed Sidmouth Rock. Eddystone Rock is 30 metres tall and rising straight out of the sea, which is why Captain Cook named it after Eddystone Lighthouse in the UK. Australasian Gannets and Black-faced Cormorants were breeding on top of the rock and on various ledges down the side. We also counted 28 Fur Seals in the area.

From Eddystone Rock we motored several kilometres west towards Pedra Branca, which in places is twice as high as Eddystone Rock. As we approached it looked like a white ship steaming along in full sun under a clear sky. The skipper slowly motored the boat as close as possible around the island, the calm conditions giving us excellent views and plenty of photo opportunities. By carefully analysing our photos of the island after the trip, we counted 1,828 Australasian Gannets breeding on the rock and 16 Shy Albatross chicks (Plate 1). To our delight, we also later identified five Pedra Branca Skinks (*Carinascincus palfreymani*) basking in the sun on the rock faces and crevices below a small group of Black-faced Cormorants on the southern end (Plates 2 and 3).

Birds around Eddystone Rock and Pedra Branca were estimated at 2,800 Australasian Gannets, 12 Kelp Gulls, 30 Silver Gulls, 50 Short-tailed Shearwaters, 56 Greater Crested Terns, 2 Shy Albatross, 6 Buller's Albatross, 4 Common Diving Petrels, 5 Black-faced Cormorants and 3 White-fronted Terns (*Sterna striata*).

Mammals seen included 120 Australian Fur Seals and 20 Long-nosed Fur Seals (*Arctocephalus forsteri*).

At one stage we watched a school of what were thought to be Southern Bluefin Tuna (*Thunnus maccoyii*) (but may have been a related species) and Australasian Gannets feeding on a large school of Redbait (*Emmelichthys nitidus*) at the back of the island. At the other end of the island we watched 'Pedro', the famous surfing wave, rising and crashing against the rock shelves.

At 9:20 we headed north-west from Pedra Branca towards the Mewstone arriving at 11:40. On my previous trip in January 2021 we had seen the island swarming with Shy Albatross like mosquitoes, which is also how Captain

Plate 2. The rockface on Pedra Branca showing locations of Pedra Branca Skinks. The photo was taken from the vessel at a distance of approximately 120 m using a mirrorless full-frame camera (Canon R6) and a 400 mm lens. (Photograph Ryan Francis)

Plate 3. Pedra Branca Skink (*Carinascincus palfreymani*) (photograph Hal Cogger)

Furneaux, who named the island, had recorded it in 1773. Tasman had sighted it in 1642 and described it as 'a small island like a lion'. He must have seen it outside the albatross breeding season as the Mewstone is the largest of only three Shy Albatross breeding colonies in Australia. The others are Albatross Island off north-west Tasmania, which has 5,000 pairs after the species recovered from near-extinction when it was exploited for feathers in the late 1800s, and Pedra Branca, which in 1997 had 7,500 breeding pairs. From our boat we took photos as we sailed around the Mewstone and later estimated there were 850 Shy Albatross adults and 1,466 chicks scattered on shelves and in crevices around the island, although more accurate figures are obtained regularly by scientific expeditions onto the island. In addition, we counted 300 Silver Gulls, 20 Greater Crested Terns, 40 Buller's Albatross and 90 Black-faced Cormorants.

At 13:50 we left the Mewstone to head to the Needles and to sail around the southern side of nearby Maatsuyker Island. Here we counted 12 Silver Gulls, 4 Greater Crested Terns, 1 Shy Albatross, 42 Common Diving-Petrels, 60 Black-faced Cormorants and 2 Pacific Gulls (*Larus pacificus*). Above the Gulch on Maatsuyker Island we watched an adult Wedge-tailed Eagle (*Aquila audax*) flying above the vegetation and landing on a dead tree. From photos we later confirmed that there were about 220 Australian Fur Seals, 60 Long-nosed Fur Seals; there were 3 Sub-Antarctic Fur-Seals (*Arctocephalus tropicalis*) among the Australian Fur Seals on the weedy rocks in the Gulch area.

Leaving Maatsuyker at 14:05, we headed past the nearby islands of Flat Top and Round Top before enjoying the beautiful geological formations of De Witt Island and Ile du Golfe. Here we watched 2 White-Bellied Sea-Eagles (*Haliaeetus leucogaster*) and 15 Forest Ravens (*Corvus tasmanicus*).

The sky darkened as the islands vanished behind us and we headed around the coast into a cold, wet front. Before the plastic side curtains were lowered to keep us dry from the rain and spray as we headed into the wind, we watched the beaches and mountains of the south-west. They looked dark and forbidding but we could still identify the distant black wedge of Federation Peak and other well-known landmarks.

We returned to the Southport jetty at 15:10.

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Species list: a day trip to Pedra Branca and Mewstone Island 27 February 2022 (IOC taxonomy v.10)

Diomedeidae: albatross

Shy Albatross (*Thalassarche cauta*)
Indian Yellow-nosed Albatross (*Thalassarche carteri*)
Buller’s Albatross (*Thalassarche bulleri*)

Procellariidae: petrels and shearwaters

Short-tailed Shearwater (*Puffinus tenuirostris*)
Sooty Shearwater (*Puffinus griseus*)
Fluttering Shearwater (*Puffinus gavia*)
Common Diving Petrel (*Pelecanoides urinatrix*)
Buller’s Shearwater (*Ardenna bulleri*)

Hydrobatidae: storm petrels

Grey-backed Storm Petrel (*Garrodia nereis*)
White-faced Storm Petrel (*Pelagodroma marina*)

Sulidae: gannets and boobies

Australasian Gannet (*Morus serrator*)

Phalacrocoracidae: cormorants

Black-faced Cormorant (*Phalacrocorax fuscescens*)

Accipitridae: eagles

White-bellied Sea-Eagle (*Haliaeetus leucogaster*)
Wedge-tailed Eagle (*Aquila audax*)

Laridae: gulls and terns

Silver Gull (*Chroicocephalus novaehollandiae*)
Pacific Gull (*Larus pacificus*)
Kelp Gull (*Larus dominicanus*)
Greater Crested Tern (*Thalasseus bergii*)
White-fronted Tern (*Sterna striata*)

Corvidae: crows and jays

Forest Raven (*Corvus tasmanicus*)

Delphinidae: whales and dolphins

Common Dolphin (*Delphinus delphis*)

Otariidae: fur seals

Australian Fur Seal (*Arctocephalus pusillus doriferus*)

Long-nosed Fur Seal (*Arctocephalus forsteri*)

Sub-Antarctic Fur-Seal (*Arctocephalus tropicalis*)

Scincidae: skinks

Pedra Branca Skink (*Carinascincus palfreymani*)

Pisces: fish

Bluefin Tuna (*Thunnus maccoyii*)

Redbait (*Emmelichthys nitidus*)

The roundbelly cowfish *Lactoria diaphana* in Tasmania

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Lactoria diaphana (Bloch & Schneider, 1801), the roundbelly cowfish, is also known by the common names thorny-back cowfish, diaphanous box-fish, diaphanous cowfish, translucent boxfish and transparent boxfish (McGrouther 2019), names respectively derived from its characteristic spines and the semi-transparent appearance of juveniles.

I found a fish skeleton well above the high-tide marks on South Friendly Beach on 14 July 2022. While I was confident that it was from the order Tetraodontiformes, references (Hutchins & Swainston 1986; Allen et al. 2003) were required to narrow it down to one of two species in the genus *Lactoria*, as well as checking various websites to determine that it was most likely the tropical *Lactoria diaphana*.

I was very excited about this likely identification and sought confirmation from experts: Dr Simon Grove, Senior Curator (Invertebrate Zoology) at the Tasmanian Museum and Art Gallery, was on record as having found a specimen on Maria Island in 2014 (Grove 2014). Dr Grove responded very promptly, in the affirmative. Dr Peter Last, Honorary Research Fellow, Ichthyology, CSIRO, responded two days later, also with a confirmation of my identification and a request for the specimen to be delivered to CSIRO for deposition in the Australian National Fish Collection. I had collected the specimen, for scientific purposes of course, so was happy to comply with Dr Last's request and double the number of *L. diaphana* specimens in that collection. The only other specimen in the collection was found at The Gardens, St Helens, in 2007 (Atlas of Living Australia 2007).

As the common name 'roundbelly cowfish' suggests, *L. diaphana* has a rounded ventral surface. Its honeycomb pattern is distinctive (Plate 1). A pair of short spines above and to the front of the eyes project forwards, and a pair of short caudal spines project backwards (as can be seen in Plate 2). A small dorsal spine is also present as described in the Atlas of Living Australia overview (n.d.), and my observation of the specimen I found, along with examination of other images, identify a pair of lateral spines in line with the dorsal spine (Plate 3). The Atlas of Living Australia overview also describes the snout as being steeply concave in dorsal profile, a feature which seems to be extended along the whole fish body in the dried specimens (Plate 4).

Its range is considered to be tropical, around the north-west of Western

Plate 1. Belly of *Lactoria diaphana*

Plate 2. Lateral view of *Lactoria diaphana*

Plate 3. Dorsal view of *Lactoria diaphana*

Plate 4. Concave profile of *Lactoria diaphana*

Australia and from tropical Queensland to New South Wales, where it has been found occasionally as far south as the border with Victoria. Its habitat is generally coral and rocky reefs, but also offshore sandflats and mudflats – so, it is reasonably ubiquitous! Juveniles may be found near the surface in oceanic waters.

L. diaphana is rare in Tasmania, with only a few previous confirmed sightings on record since 1955, including one from Flinders Island. My initial search only found records of five previous sightings, but further searching has revealed more confirmed sightings recorded in Redmap, bringing the total to 10 previous confirmed sightings.

In addition to the two sightings already mentioned, the Queen Victoria Museum and Art Gallery holds two specimens: one collected in 1955 in Bicheno (Atlas of Living Australia 1955), and one collected from Flinders Island in 2015 (Atlas of Living Australia 2015). The 1955 specimen was the first recording of *L. diaphana* in Tasmania (actually the first recorded specimen south of New South Wales), and is noted as being a juvenile specimen, presumably somewhat fleshy when found, as it was kept in the refrigerator for 10 days before being presented to QVMAG (Jones 1956).

Two further confirmed sightings, at Safety Cove, Port Arthur, were recorded by de Little (2010, 2016). A sighting by Barrett (2015) at Eaglehawk Neck and another by McEnnulty (2020) at Wineglass Bay are of specimens that have more soft tissue than others for which there are images provided and are identified by Redmap as important in terms of potential range extension. An even more exciting observation of a live specimen underwater was made at Bicheno by de Water (2018).

It is considered most likely that *L. diaphana* reaches Tasmania on the East Australian Current (Barry 2014; Peter Last pers. comm.). Additional evidence to support this was the presence of a small coconut and a seed of the beach barringtonia (*Barringtonia asiatica*) on South Friendly Beach on the same day as I found the specimen of *L. diaphana*.

That juveniles are found near the surface of oceanic waters potentially makes them more vulnerable to movement by currents. The maximum length of *L. diaphana* is recorded by Hutchins and Swainston (1986) as being 30 cm. The specimen I found was 18 cm in length, and presumably a juvenile. The Redmap observations do not seem to include a length but the images provided by both

Barrett and McEnnulty, in which the fish seem to have soft tissue, are consistent with the image of a juvenile in Hutchins and Swainston's field guide that shows the somewhat translucent belly. The live image provided by de Water does, however, seem to have adult colouration.

L. diaphana is identified as being venomous by Matsuura (2001). Wondering whether *L. diaphana* is venomous or poisonous (and it well may be both), I found a report of a man who died of palytoxin poisoning after eating *L. diaphana* (Shinzato et al. 2008). It appears that this was not an isolated incident as from 1990 to 2008 there were nine reports of food poisoning incidents relating to consumption of marine boxfish in just four of Japan's prefectures (Shinzato et al. 2009). The palytoxin poison is not produced by the fish, but is produced by zoanthid corals upon which the fish feed and is accumulated in the fish tissues (Shinzato et al. 2008).

It seems that palytoxin is a neurotoxin and its action is similar to that of tetrodotoxin – the toxin that has evolved as the venom of the blue-ringed octopus and the poison present in some organs of some pufferfish (Tetraodontidae), as well as a number of other animals.

While I know that the choice to eat the flesh of pufferfish (*fugu* – I believe the final test for a fugu chef in training is to prepare and eat his own fugu) is a cultural practice and apparently a culinary delight, I was unaware that boxfish were also part of this practice. I had wondered if our Tasmanian cowfish, Shaw's cowfish and the ornate cowfish, carry the tetrodotoxin poison but have never felt inclined to put it to the test to satisfy my idle curiosity – and they are protected species.

Some years ago I prepared an article for the Marine Naturalists' newsletter about the starry toadfish, *Arothron firmamentum*, and noted it had been suggested that eating fish of the Tetraodontidae family was prohibited by traditional Hebrew dietary laws. According to the Old Testament book of Deuteronomy, the eating of any fish without scales was forbidden as they were considered 'unclean'. Perhaps the ancient Jews knew what they were about! I remain content to leave the whole order Tetraodontiformes off the menu.

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An update on the identity, distribution and biogeography of the remarkable centipede *Craterostigmus tasmanianus*

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Plate 1. *Craterostigmus tasmanianus*. Modified from an image by Simon Grove, taken 11 February 2015 near Corinna.

I summarised the biology, distribution and conservation status of *Craterostigmus tasmanianus* Pocock, 1902 in *The Tasmanian Naturalist* 27 years ago (Mesibov 1995). A lot has been learned since then about the morphological peculiarities and venom of this centipede (Plate 1), but there's nothing new to report about its life history and habits, and for background I recommend reading the 1995 article (freely available online, see References).

The big news is that genetic studies have clearly separated the Tasmanian *Craterostigmus* from a less common New Zealand form, formerly assigned to *C. tasmanianus* and now distinguished as *C. crabilli* Edgecombe and Giribet, 2008 (Edgecombe & Giribet 2008; Giribet et al. 2009; Vélez et al. 2011). With its two species, *Craterostigmus* is the only genus in the family Craterostigmidae, which is the only family in the order Craterostigmomorpha, which is one of five orders in the class Chilopoda (centipedes).

I'll never forget finding my first *Craterostigmus*, on the Whyte River track near Savage River in 1973. I was familiar with the other four centipede orders, all of which are found worldwide, and I looked at my Tasmanian specimen and thought, 'This isn't possible!' It was like finding a fish with feathers; the anatomy was all wrong. There is still no agreement on how Craterostigmomorpha is related to the other centipede orders (Edgecombe & Giribet 2019).

What does seem likely, however, is that *C. crabilli* in New Zealand did not recently evolve from an introduced Tasmanian *Craterostigmus*, and *C. tasmanianus* did not recently evolve from an introduced New Zealand *Craterostigmus*. One age-estimate for the split between *C. tasmanianus* and *C. crabilli* (Giribet & Boyer 2010) is 270 million years, which vastly predates the breakup of Gondwana.

The results of an island-wide genetic study of *C. tasmanianus* (Vélez et al. 2011) were intriguing. Looking at 16S rRNA and COI loci, Sebastián Vélez found that the species is divided geographically into a number of discrete populations with subtle genetic differences. Within those populations, genetic difference doesn't neatly increase with distance across the landscape. The latter result and the presence of *C. tasmanianus* in formerly glaciated areas indicate that the species is a good disperser. Yet strangely enough, there are separate '*Craterostigmus* districts' in Tasmania, the boundaries of which have not yet been clearly defined.

C. tasmanianus is widespread in forest and woodland habitats around Tasmania from sea level to at least 1,300 m (Figure 1). Although it can grow to 60 mm in length, it's only rarely seen or imaged by naturalists because it hides so well in deep litter and rotting logs. Locally it can be remarkably abundant, especially in western rainforest. The densest populations I've seen, however, were in open *Eucalyptus pauciflora* woodland near Penstock Lagoon.

Note that the localities in Figure 1 have been checked for geographical accuracy. Unfortunately, the *C. tasmanianus* records in the *Atlas of Living Australia* include many with incorrect georeferences (latitude and longitude). For example, two of the Australian Museum localities in *ALA* are in the sea, 8 km or more north of Devonport. Further, many of the localities for Queen Victoria Museum and Art Gallery specimen lots have been georeferenced to the nearest named place, rather than to the exact locality given on the specimen label in UTM coordinates. As a result, 61 of the QVMAG records are misplaced by more than 5 km, and one is wrong by almost 70 km. Where possible, I have corrected *ALA* georeferences from my own records (Mesibov 2021) or from project reports and correspondence with collectors, but a few records had to be discarded. All records have been deposited in Zenodo (https://zenodo.org/record/6643979).

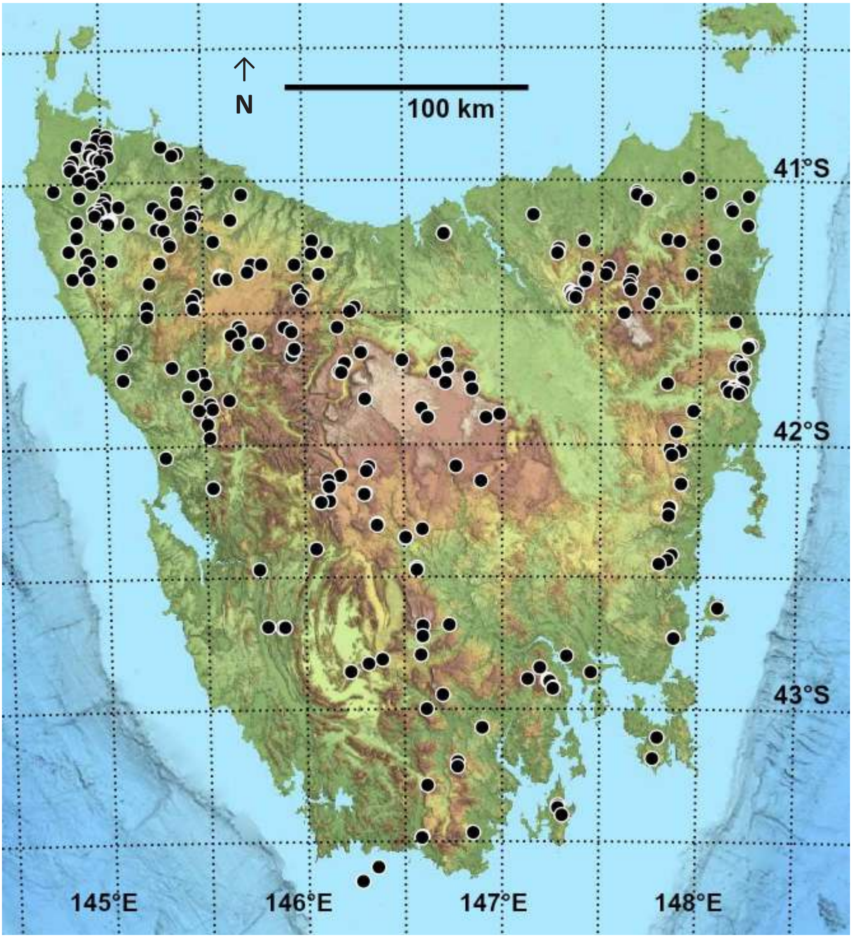

Figure 1. Localities for *Craterostigmus tasmanianus*. Identifications were checked by the author or another specialist. Coordinates have also been checked and corrected where necessary. The two offshore localities in the south are Maatsuyker and DeWitt islands. Topographic basemap from LISTmap (https://maps.thelist.tas.gov.au/listmap/app/list/map).

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The fauna of a Fern Tree garden – vertebrates and butterflies over 30 years of environmental change

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A view of our Fern Tree garden from the verandah, September 2007

Introduction

Fern Tree – Hobart's highest suburb at approximately 400 m asl and also its coldest – is situated on the slopes of *kunanyi*/Mt Wellington. The mountain is a favoured destination for naturalists, who are attracted to the flora and fauna of its wet forest and cool mountain habitats. Fern Tree is also home to more than 700 people who have chosen to live in its bush environment. We settled here 31 years ago, having bought a block of mostly cleared bush regrowth, (regenerating from the 1967 bushfires), in 1989. Since building our house and moving into it in 1991, we have been a keen observer of the fauna, in particular the vertebrate and butterfly species, occurring on the property.

Situated in the catchment of Fork Creek where it intersects Huon Road in southern Fern Tree at 440 m asl, the property is around half a hectare in size with a relatively sunny (for Fern Tree), north-eastern aspect and moderately steep slope. The surrounding area including Westringa, Grays, Browns and upper Menuganna roads is 'bush suburbia' – a mosaic of houses, gardens, rough pasture and native bush above the Pipeline Track. In the early 20th century there were several berry farms in this area which have since been turned into large residential blocks. Much of Southern Tasmania, including the whole mountain and this site, was ravaged by the bushfires of Black Tuesday, 7 February 1967. The native bush has undergone steady regeneration over the more than 50 years since then.

In the early post-bushfire years, the site was covered in dense, head-high regrowth. In the 1980s, the property's previous owner had a house site excavated, causing a large amount of fill to be pushed downslope on the block thus obliterating a substantial area of the regrowth and resulting in colonisation by exotic grasses and weeds. Most of our garden in the early days was a grassy block on which a neighbour's horse grazed. There still remained, however, an area of regenerating native wet sclerophyll bush, including a small stand of young mountain ash (*Eucalyptus regnans*) and silver wattle (*Acacia dealbata*), with their associated understorey shrubs and small trees, mainly lancewood (*Nematolepis squamea*), cheesewood (*Pittosporum bicolor*) and goldy wood (*Monotoca glauca*). This remnant native bush was mainly restricted to the south-eastern corner of the block but some of the trees were scattered around and wattles lined one side. The eucalypts are now reaching about 25 m and the wattles about 20 m, the latter becoming senescent as they are nearing the end of their natural lifespans. Elsewhere in the garden, the exotic grasses have almost completely disappeared due to our planting over the years of a 'contrived Gondwanan rainforest' of *Nothofagus* species from the southern temperate lands, other southern hemisphere trees and shrubs, and also shrubberies of banksias, grevilleas and rhododendrons. Shading from the developing canopy of these trees, plus heavy browsing by pademelons, has caused less favourable conditions for the exotic grasses and thus allowed for the succession of short swards of native *Austrodanthonia* grasses in areas that are still free of trees or shrubs and simply a leaf litter floor where this garden forest has matured. Overall, during the past 30 years, the property's vegetation structure has changed from being fairly open and grassy to semi-forested, but is still open and sunlit enough to form a forest with a shrubby verge. Our block backs almost onto the Pipeline Track, linked to it by native bush on the edges of neighbouring properties The Pipeline Track more or less marks the lower edge of the regenerated native bush on the slopes of *kunyani*/Mt Wellington with some tall older trees providing a conduit between the bush and our property.

Fortunately for our wildlife, most of the residents in the wider neighbourhood appear to be responsible pet owners who restrain their dogs and cats from roaming, thus preventing negative impacts on native fauna.

The fauna list

The following is a list of all the vertebrate species and butterflies observed in or from our garden over the past 34 years. Included are birds seen in flight and/or heard calling from the property. Comments on each species indicate its status or changes in species abundance and composition over the years. The fauna species are listed according to taxonomic groupings with their vernacular names followed by their scientific names.

Mammals

Short-beaked echidna *Tachyglossus aculeatus* – seen on two separate occasions in the garden but each time did not stay long, passing through on its search for ants.

Eastern barred bandicoot *Perameles gunnii* – seen frequently in the garden at night in the 1990s but now sighted rarely with the diminished grass cover. Conical digging holes, possibly of this species, are still occasionally observed.

Dusky antechinus *Antechinus swainsonii* – one dead individual found in the garden in the early 2000s.

Common brushtail possum *Trichosurus vulpecula* – This rumbustious species is a year-round nightly visitor to the property and favours browsing on the foliage of several South American rainforest trees. It also uses our verandah and roof as a 'gymnasium'.

Common ringtail possum *Pseudocheirus peregrinus* – A frequent resident in the garden, it builds nests in small, densely crowned trees and tall shrubs. Its 'chortling' calls are often heard at night; it too is suspected of browsing on the foliage of the South American trees. At times a ringtail possum becomes the prey of forest ravens, which hunt it out in pairs and harry it to death with their beaks.

Sugar glider *Petaurus breviceps* – The 'yapping' call of the sugar glider is occasionally heard at night in the tall eucalypts on the upslope boundary of the garden.

Little pygmy possum *Cercartetus lepidus* – One of these was found and captured in the bathroom one night in early 2021 and then released into the garden. This individual may either have been resident in the surrounding bush and found its way inside or it may have hitched a ride from the Lake St Clair area in our backpack which was in the hallway after our arrival back that day.

Red-necked wallaby *Notamacropus rufogriseus* – a fairly frequent visitor to the garden; females with joeys are seen occasionally. They favour sunny sites for basking and at times become fairly familiar and relaxed.

Tasmanian pademelon *Thylogale billardierii* – These are nearly always present in our garden, grazing or resting by day in quiet sheltered places. Males, females and joeys are all seen at various times but most abundantly around dusk as many make their way down from the bush above. These small 'living lawn mowers' have played a profound role in converting the exotic grass swards to native *Austrodanthonia* and thus in ending the need to cut the long summer grass each year.

Eastern bettong *Bettongia gaimardi* – Fern Tree is not a typical habitat for this species, which favours dry open forests; however, there was one occasion when an individual was discovered tangled in bird netting covering the strawberry patch. It was released but promptly showed its gratitude by biting the rescuer on the finger!

European rabbit *Oryctolagus cuniculus* – Adults and single small juveniles are occasionally seen in the garden, the latter indicating local breeding. They also help in keeping the native wallaby grass short.

Black rat *Rattus rattus* – occasionally seen on the property.

House mouse *Mus musculus* – occasionally seen on the property.

Non-passerine birds

Tasmanian native hen *Tribonyx mortierii* – an infrequent visitor to the garden but present in some parts of the Fork Creek catchment most of the time. Parents have been seen and heard guiding clutches of young chicks through our garden on at least two occasions.

Masked lapwing *Vanellus miles* – heard calling near the property frequently; a resident pair is known to breed in most years with varying levels of success at the nearby Grays Road – Westringa Road lawns.

Kelp gull *Larus dominicanus* – infrequently observed flying overhead.

Brown goshawk/Collared sparrowhawk *Accipiter fasciatus* / *Accipiter cirrocephalus* – *Accipiter* species are seen soaring overhead or swooping through the garden occasionally; however, because the female brown goshawk is difficult to distinguish from the male collared sparrowhawk, correct identification of the species observed has never been certain.

Grey goshawk *Accipiter novaehollandiae* – seen soaring over the property on at least two separate occasions.

Tasmanian wedge-tailed eagle *Aquila audax fleayi* – seen from our garden soaring at great height out from the slopes of the mountain on at least two occasions. The nearest known pair's territory is in the nearby Chimney Pot Hill area.

White-breasted sea-eagle *Haliaeetus leucogaster* – This was a surprise sighting with one adult bird sailing past the property in 2020, well inland and upslope of the Derwent Estuary, the nearest suitable habitat.

Brush bronzewing *Phaps elegans* – the more frequently seen and heard of the two bronzewing pigeon species that are seen in and near the garden; the abundant silver wattle seeds seem to be a major attraction for them.

Common bronzewing *Phaps chalcoptera* – This one has also been seen and heard in and around the garden in recent years, either singly or in pairs. Sometimes both bronzewing species can be heard calling simultaneously with their contrasting calls from separate spots.

Yellow-tailed black-cockatoo *Zanda funerea* – a fairly regular visitor to the garden, they come to crack open the silver banksia cones for their seeds or to break up old silver wattle branches in the canopy for wood-boring grubs. Otherwise these cockatoos frequently pass by in small flocks.

Sulphur-crested cockatoo *Cacatua galerita* – This species first appeared in the district in the early 2000s and regularly passes over in pairs or small flocks. One (presumably the same individual) visited two planted Oyster Bay pines to dine on the seeds in late spring 2021 and 2022. It has become familiar and is not disturbed by comings and goings of people.

Swift parrot *Lathamus discolor* – rarely recorded and then only flying over the property.

Green rosella *Platycercus caledonicus* – seen most days in the garden, either in pairs or sometimes in small flocks, where it finds a multitude of food sources. It particularly favours the maturing seed crops of South American *Nothofagus* species and can almost strip the canopies in mast years.

Fan-tailed cuckoo *Cacomantis flabelliformis* – A regular migratory visitor to the neighbourhood most spring seasons and at times in the garden, it is heard calling mostly from about November onwards, usually during the day but occasionally at night. It is one of the first birds to call at dawn.

Shining bronze-cuckoo *Chrysococcyx lucidus* – The same notes as for the fan-tailed cuckoo apply to this species but also, with these cuckoos, at times several males may be heard noisily courting a female at once.

Tasmanian boobook *Ninox leucopsis* – The familiar 'mopoke' night call of this small owl is heard regularly in spring in the surrounding bush, often with two birds answering each other. One was observed on the property during the day when flushed from a small tree.

Tawny frogmouth *Podargus strigoides* – Occasionally the 'ooming' call of the frogmouth is heard in the surrounding bush; once an individual was observed sitting on the edge of the guttering of the house.

White-throated needletail *Hirundapus caudacutus* – To our memory, we have seen this powerfully flying swift species only once, hawking over the property in late summer.

Laughing kookaburra *Dacelo novaeguineae* – The kookaburra is one of the local 'alarm clocks' at dawn and dusk. Kookaburras have been resident in the surrounding area in pairs or small groups during the time we have lived here but only occasionally visit our garden. A dense stand of tall radiata pines provides a regular night 'camp' on the adjoining property below Huon Road and appears to be particularly favoured for its shelter in winter.

Passerine birds

Superb lyrebird *Menura novaehollandiae* – We first heard this species calling in bush nearby, from our property in 2010. We also observed a female lyrebird in the garden on one occasion. The species is now scattered around the slopes of Mount Wellington and continues its slow but relentless spread since being released at Hastings Caves and Mount Field in the early 20th century. It can now be heard on most days in the Fork Creek catchment and at times seen on the Pipeline Track.

Superb fairy-wren *Malurus cyaneus* – The familiar 'blue wren' is a regular visitor or near-resident in our garden all the year round as a small flock or family. The species has been recorded nesting on this property on one occasion and undoubtedly does nest on adjoining properties.

Spotted pardalote *Pardalotus punctatus* – a semi-resident in the garden and neighbourhood for as long as we've been here, which has nested in the house cutting on the property. The stand of eucalypt regrowth in our garden along with tall remnant old-growth eucalypts nearby, are important food resources for this species.

Striated pardalote *Pardalotus striatus* – a regular spring and summer visitor to the garden and neighbourhood which was first noticed only about 10 years ago and is more frequent on the mountain these days.

Scrubtit *Acanthornis magna* – We have seen this species on only two occasions in the garden over the past 34 years, each time when a small flock was passing through. Although sparsely distributed around the eastern and southern slopes of the mountain, the species appears to be absent from at least the lower Fork Creek catchment.

Tasmanian scrubwren *Sericornis humilis* – resident in the garden as one pair or family party at any one time and also nesting here. The shrubberies of banksias, grevilleas and rhododendrons provide good foraging cover for this species.

Tasmanian thornbill *Acanthiza ewingii* – resident the year round in the garden, mainly in pairs. It forages at all foliage levels but more often in the canopies of the eucalypts and wattles, from which it utters a pleasant territorial call. Although we have not observed nesting, we saw newly fledged juveniles on one occasion.

Yellow wattlebird *Anthochaera paradoxa* – an itinerant resident of the garden nesting in the eucalypts and feeding on the nectar of banksia flowers, particularly the large ones of the winter-flowering *Banksia collina*. This species is at the top of the honeyeater pecking order, although New Holland honeyeaters sometimes go through the motions of chasing them.

Brush wattlebird *Anthochaera chrysoptera* – Flocks of this species have been visiting the banksia blooms in autumn in recent years and usually leave after a week or two, although one pair nearly saw out the winter in 2021.

Yellow-throated honeyeater *Nesoptilotus flavicollis* – Mainly individuals visit regularly in late summer and early autumn after the nesting season opportunistically seeking out the banksia and grevillea nectar as well as other food resources in the eucalypt canopies. The species is not resident in the surrounding Fork Creek catchment.

Strong-billed honeyeater *Melithreptus validirostris* – It is mainly an autumn visitor to the eucalypt regrowth stand in small flocks searching the ribbon bark for invertebrates. Their pleasant chattering dawn chorus is heard at first light. This species is widely scattered around the slopes of the mountain but does not appear to be resident in the surrounding Fork Creek catchment.

Black-headed honeyeater *Melithreptus affinis* – Small flocks visit regularly in late summer, foraging briefly in the silver wattle canopies but they never stay long.

New Holland honeyeater *Phylidonyris novaehollandiae* – There is a permanent colony which raises several broods each year in the garden thanks to the banksia and grevillea shrubberies. This honeyeater species is next one down in the pecking order from the wattlebirds; it fulfils the role of 'alarm bird' on the lookout for potential predators, thus also alerting other passerine species to danger.

Crescent honeyeater *Phylidonyris pyrrhopterus* – In most years this species fleetingly visits the garden in autumn on its downslope seasonal movements but is soon chased off by the New Holland honeyeaters. The more furtive and smaller females sometimes seem to evade detection by the latter for a while, long enough for a feed of nectar. There have been occasions though when, for example on their way back up the mountain in the spring, the crescents managed to stake a claim and stay feeding in the garden for several weeks.

Eastern spinebill *Acanthorhynchus tenuirostris* – The spinebill is at the bottom of the honeyeater pecking order; nonetheless, this furtive species is seen in the garden or neighbourhood almost all year round and is particularly attracted to the nectar of a fuchsia bush which flowers in late summer to autumn.

Golden whistler *Pachycephala pectoralis* – a frequent visitor to the garden, although mature males visit less frequently than the grey immature males or females. The sweet calls of the males are very much characteristic of spring at Fern Tree.

Olive whistler *Pachycephala olivacea* – An infrequent visitor to the garden in past years, but it has been seen and heard around our garden more often in recent times, either in pairs or singly. It is usually more common around the slopes of the mountain than in the nearby Fork Creek mid-catchment area.

Grey shrike-thrush *Colluricincla harmonica* – a regular visitor to the garden with its joyous calls in spring and summer adding to the ambience. It is fairly tame and searches the verandah for spiders, at times being quite close to the observer.

Dusky woodswallow *Artamus cyanopterus* – observed only once when a flock of them were flying high over the property in autumn on their northward migration.

Grey butcherbird *Cracticus torquatus* **–** Although we have heard it calling fairly frequently in the neighbourhood over the past 15 or so years, we have not known it to visit our garden.

Australian magpie *Gymnorhina tibicen* — We first heard it calling in nearby grassy areas in autumn three years ago and have heard or seen a pair during summer and autumn each year since.

Black currawong *Strepera fuliginosa* – Also called the 'black jay', this characteristic mountain bird is heard or seen around our neighbourhood and garden nearly all of the time, and is among the first birds to call at dawn and the last at dusk, when its bugle-like call sounds the end of the day. Mostly in autumn large noisy flocks of black currawongs gather and may settle for a while in the garden or nearby. They can also become very familiar and will quickly become demanding if any food is offered, so this is not encouraged.

Grey currawong *Strepera versicolor arguta* – This species is also present most of the time in small numbers in our vicinity and visits the garden in spring to seek out nests of New Holland honeyeaters, so as to prey on their eggs or nestlings.

Grey fantail *Rhipidura albiscapa* – A semi-resident in the garden, it has nested at least once on the property. Although regarded as migratory in winter, sightings in the garden suggest that some individuals overwinter in Tasmania.

Satin flycatcher *Myiagra cyanoleuca* – A male and a female were heard and seen around the neighbourhood for the first time in March 2022, including a female in the garden. Regrowth wet forest is not the favoured habitat of this species so it is likely these birds ventured out of their mature dry eucalypt forest habitat to forage before their migration.

Forest raven *Corvus tasmanicus* – This species is ever-present in the vicinity and raises broods most years. It is a daytime predator on ringtail possums, which it hunts out of their nests; the substantial number of road-killed possums and wallabies on Huon Road also appear to be a major food resource.

Scarlet robin *Petroica boodang* – seen as a pair throughout the year, but more frequently in winter. Whenever our vegetable patch is dug up a pair appears, along with blue wrens, taking the opportunity of gleaning the exposed soil invertebrates.

Flame robin *Petroica phoenicea* – an infrequent visitor to the property in spring, although it is common around the upper slopes of the mountain.

Pink robin *Petroica rodinogaster* – a fairly frequent visitor to the garden, particularly in winter, as both mature males and brown-coloured individuals which may be females or immature males.

Dusky robin *Melanodryas vittata* – observed in the garden on only one occasion over the years, the Chimney Pot Hill area being the nearest locality where it is observed more often.

Welcome swallow *Hirundo neoxena* – A pair passes over the property every day in summer visiting a small dam next door; apparently it nests at a house three blocks to the south.

Silvereye *Zosterops lateralis* – It is present in the garden most of the time, including in visiting flocks, and has bred here occasionally.

Common blackbird *Turdus merula* – It is present in the garden most of the time and breeds here also. The males holding their territories seem to sing at their loudest and most melodious in January–February before shutting down by the end of the breeding season.

Bassian thrush *Zoothera lunulata* – Both males and females are intermittent visitors to the garden; they can be heard calling regularly at dawn in autumn and winter in the surrounding bush.

Common starling *Sturnus vulgaris* – A pair visited the house on one occasion to check out potential nesting sites but otherwise it has not been recorded in the vicinity.

Beautiful firetail *Stagonopleura bella* – This estrildid finch is a rare visitor to the garden with a flock seen in the earlier years of greater grass cover. One was observed in 2021 and another heard at the time of writing – the first records for many years.

House sparrow *Passer domesticus* – It has bred under the roof in past years until the access points were blocked.

European goldfinch *Carduelis carduelis* – a rare visitor to the garden.

Reptiles

Black tiger snake *Notechus ater* – seen from time to time in the garden either as large adults or smaller, younger individuals. One smaller individual was in residence for a few weeks in summer 2021 and was observed resting on a banksia branch, possibly in search of New Holland honeyeater nests to prey on eggs or nestlings.

Blotched blue-tongued skink *Tiliqua nigrolutea* – It occurred more frequently on the property in the 1990s when the grass cover was much more pronounced but is now rarely seen.

Metallic skink *Carinascincus metallicus* – It was regularly seen basking on low stone walls in the earlier years when the garden was more open with greater grass cover, but it now appears to have vanished.

Tasmanian tree skink *Carinascincus pretiosus* – This is the most common skink species on the property and uses our timber house and verandah for basking and foraging, sometimes entering the house through open doors. It shelters in wood piles over winter and basks on the stone walls in summer.

Ocellated skink *Carinascincus ocellatus* – It was surprisingly recorded on piles of small stones in the vegetable garden on two occasions some years apart. The nearest suitable habitats for this species are dolerite boulder fields on the mid-slopes of the mountain and rocky areas at Neika and on Chimney Pot Hill, all of which are located several kilometres from the property. Therefore, these individuals must have wandered for some time through heavy forest regrowth to reach the garden by chance. Interestingly, both were immature, which may suggest dispersal of some individuals to new territory before reaching maturity.

Amphibians

Banjo frog *Lymnodynastes dumerilii* – It used to call from the small dam on the adjoining property and one individual was dug up from sandy soil in the vegetable patch in the early years; however, the species has not been heard since a house was built near the dam.

Common eastern froglet *Crinea signifera* – It has been heard calling once at the small dam on the adjoining property.

Brown tree frog *Litoria ewingii* – It is resident in the garden and calls before rain. Its spring breeding chorus can be heard from late winter to early summer, coming from the small dam next door.

Butterflies

Macleays swallowtail *Graphium macleayanus* – an annual visitor to the garden in late spring. Its larvae have been observed on two separate occasions on the foliage of the planted Chilean trees *Laurelia sempervirens*, a relative of the swallowtail's Tasmanian food plant tree *Atherosperma moschatum* (both tree species belonging to the southern hemisphere family Atherospermataceae).

Small white *Pieris rapae* – The notorious 'cabbage white' regularly visits on sunny days – the females to lay their eggs on larval food plants in the Brassicaceae family and the males in search of the female whites.

Yellow admiral *Vanessa itea* – Also known as the 'Australian admiral', it is a regular summer visitor to the garden but due to the absence of stinging nettles, its larval food plants, individuals do not linger long.

Australian painted lady *Vanessa kershawii* – Although a less frequent visitor than the previous species, it will stop to take nectar from lavender flowers.

Common brown *Heteronympha merope* – It was seen in the garden in summer in the earlier years when grass was more prevalent but has been seen only once in recent years.

Shouldered brown *Heteronympha penelope* – one of the two Brown species still seen regularly in the garden. A small population is on the wing in late summer and apparently is supported by the wallaby grass *Austrodanthonia*, its larval food plant.

Klug's xenica *Geitoneura klugii* – It was present in small numbers in the early years but has not been seen since.

Silver xenica *Oreixenica lathoniella* – Although present in small numbers in the early years with adults feeding at flowers of fireweed (*Senecio linearifolius*), we have not seen it in recent years except for one adult in summer 2021.

Tasmanian brown *Argynnina hobartia hobartia* – seen in small numbers in late spring in the garden and presumably supported by *Austrodanthonia*, its larval food plant.

Leprea brown *Nesoxenica leprea leprea* – An adult was seen only once in the garden, possibly from the nearby Fork Creek, where its larval food plant, the sedge *Uncinnia tenella*, may occur.

Donnysa skipper *Hesperilla donnysa* – It is occasionally seen in the garden in summer visiting flowers of flat weed (*Hypochaeris radicata*). Its larval food plant, the cutting-sedge *Gahnia grandis*, is widespread on wet slopes on the mountain.

White-banded grass-dart *Taractrocera papyria* – Seen once in the garden in the early years, it appears to be another butterfly species that is no longer present here because of the reduction of grass cover.

Discussion and conclusion

From the above account it can be seen that in the more than 30 years that we have been observing the vertebrate and butterfly faunas in our garden and in the near neighbourhood at Fern Tree, there have been changes in the make-up of these faunas. In what was once essentially a grassy block surrounded by 20-plus years of wet forest regrowth following the 1967 Black Tuesday bushfires, the replacement of much of the tall exotic summer pasture sward has become a forested and shrubby 'woodland garden' typical of many other long-established gardens at Fern Tree. Particularly evident in these changes in the fauna has been the reduction in abundance of the subfamily Satyrinae, the Brown butterflies. There has also been a reduction in reptile species diversity; for example, metallic skinks are now absent and blotched blue-tongue skinks have become rare. Of the marsupials, the eastern barred bandicoot is now rarely sighted. Somewhat paradoxically, the macropod fauna, particularly the

Tasmanian pademelon, has become an important feature of the property and played a key role in the conversion from the original exotic grass species to native grass species.

Overall, bird diversity has increased on the property with the growth of woody native and exotic vegetation. There is now a permanent New Holland honeyeater colony on the site. Bird species other than those usual to Fern Tree's climatic zone have recently become regular visitors to the near neighbourhood or our garden; these include the sulphur-crested cockatoo, superb lyrebird, brush wattlebird, grey butcherbird and Australian magpie. One neighbour has suggested that Fern Tree is becoming warmer through climate change and that this is one reason for the more frequent visitation by these species (apart from the lyrebird). However, it should also be remembered that the neighbourhood has undergone great changes in land use since at least the late 19th century, when berry farms were established, which are now bush residential allotments. This mosaic through past and present land use in what is now bush suburbia has enabled a higher level of diversity of vertebrate and butterfly species, whereas prior to settlement the study area is likely to have been dominated by *Eucalyptus regnans* wet eucalypt forest, with Fork Creek gully probably covered in rainforest. Therefore, vertebrate faunal diversity would likely have been more limited, with mammal species including the pademelon and brushtail possum, and birds including those typical of wet sclerophyll forest such as the yellow-tailed black cockatoo, Tasmanian thornbill, pink robin and Bassian thrush, all of which and many more have re-established populations or become visitors to the neighbourhood since the 1967 bushfires.

Almost inevitably, *kunanyi*/Mount Wellington and potentially the neighbourhood will be burnt by wildfire again, as the 'Jackson fire return model' (Jackson 1968a) predicted the peak probability of fire in wet eucalypt forest at between 90 and 110 years since the last fire. However, more recent climate change modelling would probably indicate a greater likelihood of wildfire recurring in a shorter interval than that predicted by Jackson's model. It will be interesting to compare the changes in the faunal abundance and diversity over the same period following a future wildfire event. Other factors may also play a role in future faunal patterns: land use may change again in this area, housing may become denser or more sparse, and fire regulations may result in large areas around habitations being cleared of vegetation.

The above account of the vertebrate and butterfly fauna in our garden at Fern Tree during this period will hopefully be an interesting reference.

Reference

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Investigating the continued impact of a *Cyrioides imperialis* (Fabricius, 1801) (Coleoptera: Buprestidae) infestation on *Banksia marginata* regeneration at 'Templestowe', Seymour, Tasmania

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Abstract

Stem-boring beetle attack can be devastating, both to the host plant, and to conservation-minded landowners. Here we provide the results of our research into the impact of the jewel beetle *Cyrioides imperialis* (Fabricius, 1801) on *Banksia marginata* specimens in a mixed tree planting, established on a property at Seymour, Tasmania, between 2007 and 2009. In finding 54% of the banskias were attacked by the beetle, tree location, position in the planting and rainfall were each likely to influence the degree of attack on the trees.

Introduction

In 2020 we reported on an infestation of the banksia borer *Cyrioides imperialis* (Fabricius, 1801) occurring in *Banskia marginata* saplings in mixed native tree plantings at 'Templestowe', Seymour (Richards et al. 2020) (Plate 1). The plantings, then aged 10–13 years, became the target of a monitoring project investigating the impact of the borer on the young host plants, which has now been conducted annually for three years.

Being a former sheep grazing property cleared of native vegetation, and situated in an undulating coastal location on the drier east coast of Tasmania, the property is subject to continual salt deposition by sea spray, while its soils suffer from a combination of historic compaction, reduced organic matter, and poor quality. These conditions combine to reduce the capacity of the soil to retain moisture at the site, increasing the likelihood of water stress, pathogens and insect attack in many shallow-rooted trees and shrubs, including those in establishing tree plantings. Such symptoms often manifest during extended periods of

Plate 1. Recently emerged adult *Cyrioides imperialis* on *Banksia marginata*

Figure 1. Monitoring site locality; location of trees surveyed at 'Templestowe' (maps Google Earth 2022)

low rainfall, as occurred in 2019–20, and were most apparent in the young banksias in the plantings established on the elevated section of the property. While many trees in the mixed planting appeared more stunted overall, evidence of stress in the banksias was in the form of considerable yellowing of leaves, leaf drop, and increased presence and attacks by insects on the foliage, compared with those in the plantings downslope. However, similar symptoms have been observed in juvenile *B. marginata* exploited by *C. imperialis* in the midlands, under a different suite of climatic and soil conditions (Richards & Spencer

2018), so the influence of slope and soil depth on banksia health may not be the only controlling factor.

Following a year of higher rainfall along the east coast, in 2022 the health of the trees showed improvement, despite the presence of several insect borers and the usual assortment of native and exotic invertebrates found in degraded landscapes. The banksias in the top planting showed flushes of new healthy, green growth and fewer yellowing leaves. Here we present the results of the three-year study into the impact *C. imperialis* is having on the *B. marginata* saplings on this property.

Methods

A monitoring program incorporating 74 *B. marginata* trees selected from within three neighbouring plantings 10–13 years old, was established in June 2020 (Richards et al. 2020). Each banksia was given a unique identification number and tagged with an aluminium label attached to a lower branch. The location of individual trees is presented in Figure 1. Monitoring was performed annually in autumn–winter, outside of the beetle activity period, and was conducted for three years. Healthy, dying, and dead *B. marginata* specimens in each planting were included in the study.

On each occasion individual banksias were inspected for presence of emergence holes of the buprestid *C. imperialis* in the trunk, branches and exposed roots (Plate 2), while stem galls of the cerambycid beetle *Tragocerus spencii* Hope, 1834 were also recorded. Additional emergence holes, obvious insect infestations and vertebrate browsing/damage in the banksias were also noted. During each monitoring event every *C. imperialis* emergence hole observed was marked with an 'X' placed across the hole, using a permanent black pen, to confirm accuracy of the count

Plate 2. *Cyrioides imperialis* emergence holes in stem and root of *Banksia marginata*

Plate 3. *Cyrioides imperialis* emergence holes marked with 'X' in a previous season

and to allow for easy recognition of new holes in subsequent surveys (Plate 3).

Data collected included geographic location, tree number, number of emergence holes, orientation/direction of emergence holes on stems, and their height above ground. Health of each *Banksia marginata* was assessed as: healthy, sick or dead, % dead, and leaf colour. Notes on dying and/or dead banksias with no evidence of emergence holes were taken, and the cause identified, where possible. Dead trees were included in subsequent monitoring events to investigate any continued use by the beetle.

Monthly rainfall data from five stations in the mid-east coast region were obtained to determine annual rainfall fluctuation. While none of the datasets were complete for the period 2018 to 2022, used together they provided evidence of a lower-rainfall year (2019–20) occurring within the study period.

Results

Of the *B. marginata* included in the study, six saplings (8.1%) were determined to be dead at the outset. A further three were classified as dead in the second year (2021) (12.2% of total), with the total climbing to 16 banksias (21.6%) in 2022. Details of dead trees, the number of emergence holes originally recorded, and number at final count per plant are presented in Table 1.

The majority of the 16 dead banksias possessed *C. imperialis* emergence holes, with only three showing no outward sign of *C. imperialis* attack. Of the latter, one had two *Tragocerus* galls, while another had evidence of other borer damage at its base, i.e. fine frass accumulating on the soil around the trunk (hence not *Tragocerus* or *C. imperialis*), as did the adjacent *Acacia* bushes, which were also dead. The cause of death of the third banksia could not be determined; however, it is possible that evidence of

Table 1. Trees deaths recorded at 'Templestowe'

Tree no.	Year of death and total emergence holes			Comments
	2020	2021	2022	
4	10			Recently fallen over, removed by owners prior to next visit
31	2	(4)		2 at death, plus additional 2 post-death
36	3			All in roots
37	0			No cause of death evident
44	2			No further emergence. *Tragocerus* present
30	5	10		5 sick, plus 5 in year of death
33	4	7		7 sick, plus 2 *Tragocerus* galls in year of death
42	13	15		13 sick, plus 2 in year of death
22	0	0	0	borer damage at base, *Acacia* spp. adjacent also dead
32	0	7	9	7 sick, plus 2 in year of death
39	5	5	22	5 healthy, plus 17 in year of death
45	4	6	11	3 in stem, 3 in roots (sick), plus 5 in year of death
46	5	5	5	4 in stem, 1 in root (sick), no additional in year of death
52	6	6	8	6 healthy, plus 2 in year of death
60	5	5	5	5, plus one *Tragocerus* in year of death
61	0	0	0	0, plus *Tragocerus* at original survey

C. imperialis emergence will present in the coming season.

Thirty-three (44.6%) of the banksias surveyed possessed at least one *C. imperialis* emergence hole at the beginning of this research. By the conclusion, 40 (54.1%) had hosted *C. imperialis* at some point during the study. There was no increase in the total number of banksias infested between 2021 and 2022, although more emergence holes were located. The cumulative total of emergence holes recorded each season is presented in Figure 2, but note that the 2020 tally was already the accumulation of several prior seasons of infestation. In 2020–21 and 2021–22, the number of new emergences recorded per monitoring event was 34 and 46 respectively.

Beetle attack was not consistent between banksia trees; 34 of the 74 banksias failed to show sign of *Cyrioides* damage by the end of the study. The largest number of emergence holes (22) occurred in a single dead banksia in 2022, a tree that had only seven emergences the previous season, at which point the plant was alive and appeared healthy. Of the 74 banksias, 11 (14.8%) had 7

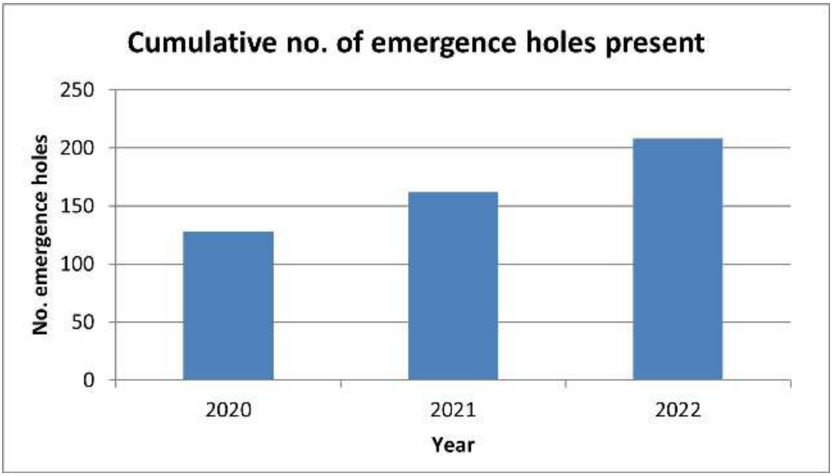

Figure 2. Cumulative total of emergence holes recorded during the study

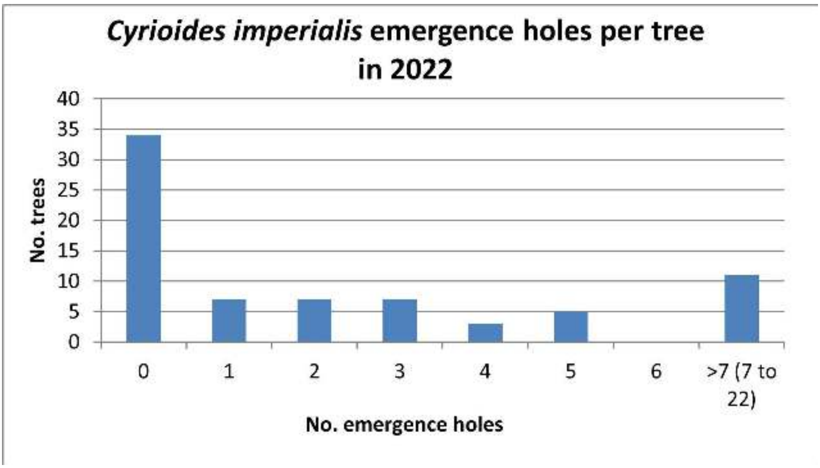

Figure 3. Emergence holes per *Banksia marginata* in 2022

or more holes; however, 1–3 holes per banksia was most commonly observed, occurring in 21 of the 74 trees (28.4%) (Figure 3).

Banksias along the periphery of the plantings had the most emergence holes, while those in the interior rarely showed evidence of beetle use, those that did almost always presenting as willowy specimens of poor form, very thin and with minimal canopy. Dying or visibly stressed *B. marginata* supported the greatest number of emergence holes. In some instances, such trees also had increased insect damage to their foliage and possessed above-average numbers of emergence holes (7 or more emergence holes). Dead trees, however, seldom showed evidence of ongoing *C. imperialis* use, and never for more than a single season.

Visible signs of declining tree health varied between seasons, with banksias in April 2020 displaying the poorest symptoms, such as distinct yellowing of leaves, leaf drop and stunted, minimal new growth, perhaps accounted for by the lower annual rainfall. By April 2022, many of the banksias were evidently recovering, the leaves transitioning from definite yellow to some green tinge, and containing a flush of new, healthy green (albeit light green) leaves on many branches.

A few additional tree borers were recorded on the banksias, including the longhorn beetles: *Tragocercus spencii, Cnemoplites australis* (Erichson, 1842) and *Toxeutes arcuatus* (Fabricius, 1797), weevil species (to be determined), and lepidopteran larvae such as *Psalidostetha banksiae* Lewin, 1805, also known as the banksia moth. The main vertebrate foliage browser, detected by presence of scats and signs, was the common brushtail possum *Trichosurus vulpecula* (Kerr, 1792). Black cockatoo *Zanda funerea* (Shaw, 1794) activity in the plantings occurred in the form of stem attack at the *Tragocerus* gall sites on two of the banksias, the birds using their powerful beaks to extract the larvae, further damaging the plant in the process. Clearly each of these species contributes to the decline of some banksia trees, but even where usage was evident, all the trees remained alive, and so no one species is likely to cause tree death.

Discussion

Continual use of the banksia resource by *C. imperialis* at 'Templestowe' was confirmed by the increasing number of emergence holes detected across the period of study. By April 2022, over 54% of the *B. marginata* specimens showed sign of *C. imperialis* use. This level of infestation, combined with damage caused by other insects and vertebrates, has resulted in the high mortality (over 20%) of the banksias within the first 15 years of planting, suggesting that the long-term viability of the banksias at this site may be in doubt.

Despite the close proximity of the plantings, the *C. imperialis* exploitation appears highly localised, with the influence of plant position, i.e. 'edge effect', notable. Easy access to larval food plants appears to be important to the selection of egg-laying sites by the beetles; most favoured were the banksias planted along tracks and other open areas. The beetle's flight pattern, being slow and cumbersome and therefore better suited to open areas, may directly influence the selection of banksias in open positions. Frequency of tree deaths, combined with increased numbers of emergence holes in trees adjacent to tracks appears to confirm this, and it is supported by evidence from the internally planted banksias, which showed fewer signs of beetle attack, albeit exhibiting reduced growth rates, possibly as a result of light deficiency and competition with faster-growing eucalypts.

However, other factors may contribute to the localised beetle selection of banksias. One potential explanation may be the direct influence of soil moisture on banksia health, since the plants located in more depauperate soils (shallower, less nutrients) may have limited ability to take up water and therefore suffer reduced health. This could perhaps signal to beetles a reduced capacity for defence, thus attracting greater beetle attention, beetles more likely to attack trees in poor condition (Elliot & deLittle 1985). Alternatively, the proximity of faster-growing eucalypts species with a greater capacity for water uptake may influence banksia health, weakening the banksia understorey, again making them more prone to attack. While these are possible explanations, it might also be that a chemical signal emitted by banksias following initial *C. imperialis* usage attracts further beetle interest, thus increasing the potential for further infestations.

While it is clear *C. imperialis* inflicts significant damage to many of the host plants, a few banksias did reveal an ability to heal emergence wounds. While, in general, emergence holes expand with tree growth and age, increasing in diameter with the surrounding bark cracking, occasionally a marked emergence site would appear smaller and misshapen, to the extent that it would have been difficult to confirm its origin without the marking of an 'X' to signify a previous exit hole. Where this was observed, the banksia tended to be a faster-growing, healthier specimen.

The decline of banksias at 'Templestowe' is likely to have been due to a combination of factors, including dry summers, the locations of trees planted on the higher ground with poor soil structure and limited water retention, as well as proximity of natural populations of the beetle in the landscape. Clearly there must be a natural population of *C. imperialis* in the stands of coastal banksia at Seymour. What then does this mean for the future of the 'Templestowe' banksias?

From the results, it appears likely that *C. imperialis* will continue to target specific trees in the conservation planting, therefore the prospect of additional banksia deaths remains high. The survivorship of the banksias and final composition of the tree plantings remains to be seen. The age at which *C. imperialis* first use trees is uncertain, but previous research indicates that the beetle prefers young banksia trees (Richards & Spencer 2018). The final outcomes may hinge upon a combination of factors including climate change, which will impact rainfall levels, along with the maturity of the banksias and their resilience to beetle attack. It may yet be that a proportion of the banksias will survive the period of beetle attack, since mature specimens are expected to be less favourable to beetles. As the trees mature, fatalities will likely decline, the banksias becoming more able to tolerate some level of infestation, while the beetles continue targeting trees of poorer condition.

Thus, while not all banksias will succumb to *C. imperialis* use, consideration needs to be given to replacing dead or dying banksias. It is likely that replanting banksias at this site will only prolong the *Cyrioides* presence, so perhaps a different suite of native trees or shrubs less attractive to the beetle might be introduced to the site into the future.

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Aquatic escape response observed in the Tasmanian tree skink (*Carinascincus pretiosus*)

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The endemic Tasmanian tree skink, *Carinascincus pretiosus* (O'Shaughnessy, 1874), is one of the most common and widespread of Tasmania's 17 skink species. As the name suggests, it is semi-arboreal and commonly observed foraging on tree trunks, fallen timber and less commonly, rock outcrops. This lizard is distinctly dorsolaterally flattened with relatively longer toes than all other Tasmanian skinks reflecting its preferred microhabitat retreats under loose bark and deep inside splits in both standing and fallen timber (Hutchinson et al. 2001). *Carinascincus pretiosus* appears to be ecologically flexible, occurring within a diverse range of ecological communities, habitats and regions: from tall forests to the rocky coastline, and from Tasmania's high altitude areas down to the supralittoral zone (Hutchinson et al. 2001; Atlas of Living Australia 2022). In addition, this species is widespread throughout Tasmania's offshore islands (Brothers et al. 2001). It primarily feeds on invertebrates; however, it has also been documented feeding on nectar (Wildlife Management 2022). The species shelters and overwinters in communal groups, and females give birth to 1–3 live young in February (Hutchinson et al. 1989).

Predator avoidance in skinks

Mammals, birds, other reptiles and even some invertebrates predate skinks (Daniels & Heathwole 1984 in Hutchinson 1993). To avoid detection by predators, skinks rely primarily on crypsis (immobility, camouflage, shape). If detected, and the predator is within a critical distance, skinks will typically flee to cover as the predator approaches. As a final self-preservation measure, many species of skinks resort to caudal autotomy (self-amputation of the tail); this is probably their best-known defensive behaviour (Hutchinson 1993).

Rapidly changing microhabitats is another way in which skinks may avoid a predator. One example is when terrestrial species use water to escape from terrestrial predators. Bauer and Jackman (2008) identified 73 lizard species that regularly use aquatic habitats for sleeping or foraging, or even running over the surface. There are also terrestrial lizard species that use water as a refuge from predators when under immediate threat. For instance, skinks in the genus *Eulamprus* readily enter water to escape danger (Wilson & Swan 2017). The Australian water dragon (*Intellagama lesuerii*) uses aquatic escape to reduce the

Plate 1. The near vertical granite wall (~3 m) topped with sandy soil and *Poa* grass that backed onto the intertidal zone. These fissures drained freshwater down to the low water mark.

Plate 2. Small, shallow freshwater pools in the intertidal zone that were created by a trickle of freshwater draining from the adjacent elevated *Poa* grass that is visible in Plate 1

risk of predation by birds, snakes and other lizards, but is also known to sleep underwater, which in itself provides protection from terrestrial predators (Doody et al. 2014). In Tasmania, the endemic alpine cool-skink, or northern snow skink (*Carinascincus greeni*), will not hesitate to dive under submerged rocks if pursued even though the temperature may be as low as 5 °C (Rawlinson 1975). Another Tasmanian endemic skink, the ocellated skink (*Carinascincus ocellatus*), has been observed by Erik Wapstra, entering a lake to escape him, and on two other occasions escaping white-lipped snakes (*Drysdalia coronoides*), a known skink predator (E. Wapstra pers. comm.; Shine 1981). What differentiates the ocellated skink's behaviour from that of the Australian water dragon and alpine cool-skink is that these ocellated skinks soon swam back to shore, rather than submerging themselves for an extended period.

This paper describes the sub-surface aquatic escape response of another Tasmanian endemic, the Tasmanian tree skink.

Observed behaviour

The observed behaviour took place on 29 December 2021 at the northern bay of Three Gullies Bay, on the eastern side of Three Hummock Island, north-west Tasmania (centred on –40.40289, 144.95975). It occurred in the mid-intertidal zone during the hottest part of the day (1.45 pm) when the predicted tide was 1.3 m (down from a predicted high of 2.2 m) and about 1 hour 15 minutes before low tide. The intertidal zone was comprised of exposed and deeply fractured/eroded granite boulders that backed onto a ~3 m vertical granite rockface, above which was sandy soil and tussock grassland (*Poa* sp.) (Plate 1). Freshwater was trickling down from the elevated tussock grassland following a fissure along the base of a boulder until it reached the low water mark. A number of small, shallow pools (~50–60 mm deep) formed along the length of the trickle (Plate 2).

The sudden appearance of the author disturbed the skink. It had been atop an exposed rock and likely feeding on small flying insects that were swarming above it. The author saw the skink flee directly to the freshwater pool, enter the water and take hold of the substrate at the bottom of the pool; it remained stationary for approximately 5 minutes, as long as the author could stay still (Plate 3). The skink was picked up for a photograph (Plate 4) but did not attempt to flee.

There appeared to be other escape options only centimetres away, such as rock crevices, but these were ignored by the fleeing lizard (Plate 2).

Discussion

This is the first record of a Tasmanian tree skink deliberately entering freshwater in response to a perceived threat. More observations are required to confirm aquatic escape as a behavioural trait for this species. However, this skink opted to enter the water instead of making for shelter above the water in nearby crevices.

Plate 3. The Tasmanian tree skink exhibiting aquatic escape response; the skink remained submerged and stationary, holding onto the substrate in ~50–60 mm of freshwater within the intertidal zone for approximately 5 minutes until disturbed by the author.

Plate 4. The Tasmanian tree skink removed from the freshwater pool; no flight response occurred.

There are a number of recognised predators of skinks present on Three Hummock Island. All three Tasmanian snake species, the white-lipped, tiger (*Notechis scutatus*) and lowlands copperhead (*Austrelaps superbus*; see Fearn et al. 2012), and a number of skink-eating birds including forest raven (*Corvus tasmanicus*) and Australian kestrel (*Falco* (*Tinnunculus*) *cenchroides*), and the introduced cat (*Felis catus*) (Bryant 2008; Wildlife Management 2022). It is also possible that the Pacific gull (*Larus pacificus*) and silver gull (*Chroicocephalus novaehollandiae*) would be opportunistic predators. All these predators have been observed at different times by the author in the supralittoral/littoral zone on the island.

It is unknown how long the observed skink would have remained submerged if left undisturbed. The alpine cool-skink, as mentioned above, exhibits aquatic escape behaviours but duration of submersion has not been documented. Similarly, the frequency and duration of in-water predator avoidance in highland ocellated skinks remains undocumented. It would appear that from the limited information described in this paper, predator avoidance by entering water bodies may be a more common and widespread behaviour in Tasmanian skinks than currently appreciated. Information necessary to fully understand the benefits and implications of aquatic escape would include time-in-water, water depth, dive depth and temperature. Being ectothermic (regulating body temperature by exchanging heat with the surrounding environment), immersion in water could negatively impact a lizard's physiology and behaviour depending on the water temperature and time immersed. An unfavourable temperature and/or immersion time could impact the lizard's ability to gather and process food, reproduce, and avoid predation for a short time after the event (Huey 1982).

In this reported case, a Tasmanian tree skink exhibited aquatic escape response and was able to dive to, and remain at, a depth of 50–60 mm of water for at least 5 minutes. Naturalists should watch for similar behaviour in this and other skink species and note the variables listed above.

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Stray fauna and stray recollections – a compilation of previously undocumented sightings by the author of uncommon or rare fauna in Tasmania since the 1970s

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Introduction

A recent illness involving a period of medically enforced rest and treatment has given me time to reflect on my life-long interest in natural history, my involvement in various aspects of nature conservation work in Tasmania and recreational bushwalking to remote places with less familiar flora and fauna. Through this extensive time spent in the Tasmanian bush since the 1970s I have seen or heard a number of rare, uncommon or seldom-seen fauna species on the Tasmanian mainland, which I have not previously documented. Most of these species are readily identifiable; a number of them I am also familiar with from mainland Australia, where they are common. These records, arranged according to order rank, are as follows:

Avifauna

Australasian grebe *Tachybaptus novaehollandiae* – mid-2000s, Powranna; one bird observed on a farm dam at a forested site at approximately 147°25'E, 41°45'S. The apparently curious bird approached to within 10 m allowing easy recognition.

Black-shouldered kite *Elanus axillaris* – 2015, North Esk River, Newstead, Launceston; one bird seen hovering over the swampy grasslands adjoining the North Esk River at approximately 147°01'E, 41°26'S. It was watched for a few minutes before it flew off to the south.

Dusky moorhen *Gallinula tenebrosa*

– January 1982, Nile; one bird observed on a well-vegetated farm dam at approximately 147°18'E, 41°39'S.

– c. 2015, Prospect Vale Wastewater Treatment Plant ponds at Pitcher Parade, Prospect Vale, Launceston; a pair observed on a well-vegetated post-treatment pond at approximately 147°07'E, 41°18'S.

Magpie lark *Grallina cyanoleuca* – 13 April 1979, Westbury; one bird (sex not determined) observed from a car, sitting on a roadside agricultural fence to the south of Westbury at approximately 146°49'E, 41°34'S. The bird then flew up and landed on the branch of a dead eucalypt.

Nankeen kestrel *Falco cenchroides*

– November 1982, Rattler Range; one bird observed hovering over the grassy crest of the Rattler Range to the south-west of Weldborough at approximately 147°50'E, 41°10'S. This bird was observed within visual range of the Furneaux Group of islands to the north-east, which is the centre of its range in Tasmania.

– early March 1990, Mount Solitary; one bird observed hovering over the open sedgeland crest of the peak at approximately 146°15'E, 42°55'S. The bird was observed at close range so was readily distinguished from the bulkier form of the brown falcon, which also has a hovering habit over such sites. This sighting was well outside of its range of sporadic occurrence on the northern coasts of mainland Tasmania.

Rufous night heron *Nycticorax caledonicus* – early 2000s, Legana; three birds were flushed from an island copse of trees in a dam at the former 'Serenity Gardens' restaurant and gardens at approximately 147°03'E, 41°23'S. The paperbark swamp in the nearby Tamar Wetlands Conservation Area is likely to have been the species' local roosting area.

Willie wagtail *Rhipidura leucophrys* – October 2007, Robbins Island; one bird seen foraging around bushes at farm buildings in the south-east of the island at approximately 145°10'E, 40°40'S. Seen close up, it is impossible to mistake it for the related grey fantail.

Amphibia

Striped marsh frog *Lymnodynastes peronii*

– early 2000s, Legana; one heard calling in a dam at the former 'Serenity Gardens' restaurant and gardens at approximately 147°03'E, 41°23'S. It is readily distinguished by its 'whuck' call from the related banjo frog's 'plonk' call (Littlejohn 2003), which was also heard at the same dam.

– November 2011, Stony Head Military Range; heard calling at two separate wetlands within the military range, along with the more common banjo frog at approximately 147°00'E, 41°00'S.

– November 2021, Waterhouse Conservation Area; heard calling at one wetland beside Homestead Road at approximately 147°35'E, 40°50'S.

– November 2021, Bird Hide wetland, Bakers Beach, Narawntapu National Park; one heard calling at approximately 148°35'E, 41°09'S.

Lepidoptera

Caper white *Belenois java*

– November 1969, Knocklofty, West Hobart; as a teenager, when collecting was still what naturalists did, I captured one adult male flying over a foothill of Knocklofty at approximately 147°18'E, 42°54'S; this specimen resides in my collection.

– January 2004, Bellbouy Beach; several adults sighted flying around shrubs on coastal dunes at approximately 146°50'E, 41°05'S.

– mid-2000s, Great Musselroe Bay; several adults sighted flying around bushes overlooking the coast at approximately 148°05'E, 40°45'S.

Lesser wanderer *Danaus petila* – March 1984, Heybridge coast; two adults sighted flying around vegetation in the supra-littoral zone of the Bass Strait coast at approximately 146°00'E, 41°10'S.

Long-tailed pea-blue *Lampides boeticus* – December 2016, Cataract Gorge, Launceston; I saw one adult butterfly basking in dry forest at Cataract Gorge at approximately 147°07'E, 41°26'S, as well as seeing several other adults in flight, presumably of this species, at the adjoining suburb of Trevallyn in the same month. This species was reported by the late Len Couchman (pers. comm.), an authority on butterflies, to be an intermittent migrant in Tasmania from mainland Australia during late summer to early autumn, so these sightings were earlier than usual.

Orichora brown *Oreixenica orichora* – 26 December 1975, Lake Ewart; adult butterflies seen flying over sedgy grassland beside the lake at approximately 145°50'E, 41°50'S. This may be the most westerly occurrence of this species in Tasmania and is well to the west of its mapped range centred on the Central Plateau and the Cradle Mountain – Lake St Clair region (Atlas of Living Australia n.d.).

Odonata

Blue skimmer *Orthetrum caledonicum* – early 2000s, Legana; two males seen hawking and resting on the muddy verge of the dam at the former 'Serenity Gardens' restaurant and gardens at approximately 147°03'E, 41°23'S. This species of libellulid dragonfly with a powder-blue and black-ended abdomen is distinct from any other Tasmanian dragonfly species.

Discussion

This list of my sundry observations of lesser-seen fauna dating back to the end of the 1960s can be divided into three general categories:

The first is that of vagrants to Tasmania – birds and butterflies from the mainland, whose occurrences on the island may be attributed to strong northerly winds associated with intense anticyclonic pressure systems blowing southwards to Tasmania in summer. A host of other mainland land and freshwater bird species as well as some other butterfly species that are not normally present in Tasmania have been recorded by others over the years. Of the bird species in the above list, the black-shouldered kite, magpie lark and willie wagtail fit this category and all three are occasionally seen in Tasmania; the butterfly species include the caper white and lesser wanderer. The long-tailed pea-blue butterfly, which appears to be a regular late-summer visitor to Tasmania according to the late butterfly authority Len Couchman (pers. comm.), is potentially classifiable as an intermittent migrant species to the island, not normally overwintering here. However, my early-summer records of this species from Trevallyn may indicate that sometimes they may breed in Tasmania in late summer, survive the winter as larvae and emerge as adults in the warmth of the late spring.

The second category is of species recorded from northern Tasmania which are at the most southerly limits of their predominantly mainland Australian ranges. One of these, the striped marsh frog, is localised in coastal and near-coastal localities in the north-east and north-west of Tasmania, as well as on King Island (Atlas of Living Australia n.d.). Three of my records – from the Stony Head Artillery Range, the upper Tamar region and Bakers Beach, Narawntapu National Park – appear to represent new localities some distance from the nearest plotted localities according to the Atlas of Living Australia. The blue skimmer dragonfly is an uncommon species with the few Tasmanian records centred in the greater Tamar region (Atlas of Living Australia n.d.); my record represents an additional recorded occurrence of it within this region.

The third category is of species resident in Tasmania but only sporadically recorded. Three of these were simply interesting as they are uncommonly seen and the fourth, as it was at the very western end of its range extension. The Australasian grebe has been seen over the years in Tasmania but has always been uncommon, as have the dusky moorhen and nankeen kestrel, these three species having been observed more often in the northern part of the island. The record of an orichora brown butterfly from Lake Ewart represents a westward extension of its Central Highlands range (TFNC 1994).

In conclusion, none of these records are of species new to Tasmania, nor are they particularly unexpected. Nevertheless, they are of interest because of the relative infrequency of sightings of these species on the island. From a conservation perspective, the most significant records are the new localities recorded for the striped march frog *Limnodynastes peronii*, which is listed as Endangered at the state level under the schedules of the Tasmanian *Threatened Species Protection Act 1995*. These recent records of the striped marsh frog may add to the understanding of the conservation status of this species in Tasmania.

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Highlights of pelagic birding from Eaglehawk Neck 2021–22

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This is the 11th in a continuing annual series of articles summarising the highlights of pelagic sea birding off Tasmania's coast.

From July 2021 to June 2022 there were 28 pelagic trips leaving from Pirates Bay on the Tasman Peninsula on the MV *Pauletta* skippered by John Males. Deckhands throughout the period included Michael Males, Brock Males, Bridget de Lange, Craig Hansen, Dru Hansen, Bruce Davison, Will Peart and Mitchell Drysdale.

I was on board the pelagic trip on 24 July 2021. It was led by Paul Brooks, who also compiled the report. The unresolved highlight of the trip came later in the day when a Commic Tern (*Sterna* sp.) (possibly Arctic or Antarctic Tern) was sighted flying by in the mid-distance. The other highlight was the re-sighting of a Gibson's type Wandering Albatross (*Diomedea antipodensis*) sporting an orange band no. 214, which, as we later discovered, indicated that it had been banded on Adams Island, New Zealand, in December 1996.

I was unable to join the trip that Mona Loofs-Samorzewski led on 29 August. However, it was reported that the air temperature stayed in single digits all day with relatively calm conditions. After a slow start, the birds began to appear and the birdwatchers were treated to excellent views of a beautiful adult Light-mantled Albatross (*Phoebetria palpebrata*). Other highlights included a Grey Petrel (*Procellaria cinerea*), 2 Blue Petrels (*Halobaena caerulea*), a Salvin's Albatross (*Thalassarche salvini*), 6 Soft-plumaged Petrels (*Pterodroma mollis*) and 2 White-headed Petrels (*Pterodroma lessonii*) around the boat, possibly the same one or two birds. In addition, at least two Humpback Whales (*Megaptera novaeangliae*) were observed blowing in pelagic waters and a third Humpback was seen on the way back to port while a European Honey Bee was flying near the stern.

The pelagics scheduled for 4 and 5 September were both BirdLife Australia trips organised from the mainland, but the mainlanders could not make these due to COVID-19 restrictions, so they were filled by locals and led by Karen Dick and Peter Vaughan. In the early hours of 4 September as Peter Vaughan collected me from my home, we both distinctly heard the call of an Australian Masked Owl (*Tyto novaehollandiae*) from my neighbour's suburban garden. This was subsequently confirmed by my neighbour, whose son had seen the bird there earlier. It was an exciting start to the day for us both.

The highlights of that Saturday's pelagic were 3 Northern Royal Albatross (*Diomedea sanfordi*), 8 Southern Royal Albatross (*Diomedea epomophora*), a Salvin's Albatross and 9 Providence Petrels (*Pterodroma solandri*). On the Sunday there were 3 Northern Royal and 5 Southern Royal Albatross, and 3 Providence Petrels.

The trip on 25 September set out the morning after a strong cold front had crossed southern Tasmania, bringing snow down to 300 metres. The forecast was for a 4- to 6-metre swell and 20- to 30-knot wind with 2- to 4-metre seas. Despite reassurance from Paul Brooks that this was not quite that dramatic, the skipper made the decision to return to port halfway to the shelf. All on board were naturally disappointed as they had hoped to see some interesting birds that might have come through with the front, but they did witness the return of hundreds of Short-tailed Shearwaters (*Ardenna tenuirostris*) over the shelf.

The following day, Sunday 26 September, Paul Brooks led a trip in sunny weather. As well as the highlight of seeing a Southern Fulmar (*Fulmaris glacialoides*), it was exciting to photograph an Australasian Gannet (*Morus serrator*) carrying a strand of kelp as nesting material, an indication that they were preparing to breed on the Hippolyte Rock again.

Paul Brooks described the following pelagic on 13 November as a vintage November trip with an excellent showing of *Pterodroma* petrels and Long-tailed Jaegers. Light easterly to south-easterly winds were the best conditions to catch large flocks of these birds moving into Southern Ocean feeding grounds. Highlights included the excellent counts of 95 Mottled Petrels (*Pterodroma inexpectata*), 14 Cook's Petrels (*Pterodroma cookii*), 25 Gould's Petrels (*Pterodroma leucoptera*) and 12 White-headed Petrels; probably a record count for Eaglehawk Neck of 11 Long-tailed Jaegers (*Stercorarius longicaudus*), in a variety of plumages; another probable record of 21 White-fronted Terns (*Sterna striata*); a Soft-plumaged Petrel and a Northern Royal Albatross.

I was very lucky to be invited on board Rob Morris's pelagics on 27 and 28 November because on the Saturday there was a probable sighting of Pycroft's Petrel (*Pterodroma pycrofti*; the first record for Tasmania, and the second for Australia) BirdLife Australia Rarities Committee submission pending. Further highlights were 1 South Polar Skua (*Stercorarius maccormicki*), 3 Black-bellied Storm-Petrels (*Fregetta tropica*), 1 Flesh-footed Shearwater (*Ardenna carneipes*), 38 Mottled Petrels, 1 Cook's Petrel, 1 Gould's Petrel, 1 Soft-plumaged Petrel, 25 White-headed Petrels, 5 Long-tailed Jaegers and 1 Salvin's Albatross.

On Sunday 28 November the highlights were 1 Northern Royal Albatross, 5 Mottled Petrels, 1 Soft-plumaged Petrels and 9 White-headed Petrels.

The trip on 11 December was organised by Paul Brooks and led by Rob Hamilton. We had 10- to 20-knot south-easterly wind with 1- to 2-metre swell and choppy surface. Highlights were

Plate 1. Black-winged Petrel *Pterodroma nigripennis*

counting 159 Mottled Petrels, 4 Cook's Petrels, 2 Gould's Petrels, 83 White-headed Petrels, 5 Antarctic Prions (*Pachyptila desolata*) and 3 Northern Royal Albatross, with 19 great albatross in total.

The 12 December trip was led by Paul Brooks. In his report, Paul wrote that this pelagic was made exceptional by the late appearance of a Black-winged Petrel (*Pterodroma nigripennis*) making a couple of passes, the second record of this species for Eaglehawk Neck pelagics. Fortunately, I was able to take a photo that shows its defining broad, black carpal-bar (Plate 1). A brief sighting of a Flesh-footed Shearwater was an uncommon occurrence on Eaglehawk Neck pelagics, as was that of an Antarctic Prion in December. There were also 24 White-headed Petrels, 26 Mottled Petrels, 3 Soft-plumaged Petrels and 2 Cook's Petrels, all heading south. Of note were unusually high numbers of Lion's Mane Jellyfish (*Cyanea capillata*). I enjoyed photographing two Shy Albatross (*Thalassarche cauta*) that were preening. One bird delicately cleaned the head, neck and bill area of the other bird, which was obviously enjoying the experience. A third Shy Albatross joined them briefly for a short preen as well.

The pelagic trip on 31 January was organised by Inala Nature Tours and guided by Paul Brooks, who also compiled the report. Paul described the trip as a great day at sea with high diversity and numbers of birds surrounding the boat for most of the day. There was a record count for an Eaglehawk Neck trip of 22 Buller's Shearwaters (*Ardenna bulleri*) mainly heading south, comprising 2 birds counted offshore in the morning, 17 in pelagic waters and 3 offshore in the afternoon. A total of 19 Wedge-tailed Shearwaters (*Ardenna pacificus*) mainly heading south was another record count for an Eaglehawk Neck trip. In addition, there were three locally uncommon Flesh-footed Shearwaters and clear views of a pale morph of Long-tailed Skua and an out-of-season Brown Skua (*Stercorarius antarcticus*). The sighting of a Great Egret (*Ardea alba*) in full breeding plumage on the Hippolyte Rocks also attracted great interest.

Rohan Clarke from Monash University led the next pelagics on 5 and 6 February 2022. Because some mainland birders had to cancel, I was on both trips. On the Saturday, conditions were mild to warm with light winds, very gentle seas and an overcast sky. Most notable was a steady stream of *Pterodroma* petrels, almost without exception travelling from north to south at and beyond the shelf edge. There was a variety of albatross and petrels, including an older adult male Wandering or "Snowy" Wandering Albatross, 2 Soft-plumaged Petrels, 8 White-headed Petrels, 16 Mottled Petrels, 38 Cook's Petrels, 57 Gould's Petrels and 80 White-chinned Petrels (*Procellaria aequinoctialis*), all heading south. Rohan commented that a Wedge-tailed Shearwater was an unusual sighting, though records have been creeping up over recent years.

On Sunday 6 February 2022, the weather was exceptionally calm, which would normally not be good for seabirds as they find it harder to smell the berley and need the wind for elevation. We headed out into a 5-knot easterly wind that dropped off completely beyond the shelf to leave us sitting comfortably

Plate 2. Amsterdam Albatross *Diomedea amsterdamensis*

on a glassy sea. Nevertheless, despite our lowered expectations, the bird sightings were phenomenal. First on the list were a South Polar Skua and a Brown Skua. There were 61 White-faced Storm-Petrels (*Pelagodroma marina*) and 121 Mottled Petrels, which, according to Rohan, was an extraordinary count. Most of these birds were on passage as single birds to groups of three, and almost without exception the birds were tracking north to south. There were exceptional counts of 27 Cook's Petrels and 25 Gould's Petrels, also tracking south, and a total of 51 White-chinned Petrels. The count of 47 Buller's Shearwater was described by Rohan as likely the highest single-day count in Australia ever! A single Little Shearwater (*Puffinus assimilis*) was another highlight as we do not see this species often. It typically flies close to the water surface with short bursts of rapid wing beats alternating with short glides and little to no banking. As if all of these birds had not created enough excitement, there were two more species that were 'lifers' for this seasoned 'pelagic tragic'. The first was a large brown albatross flying in from behind the boat. As Rohan suspected it might be an Amsterdam Albatross (*Diomedea amsterdamensis*), he shouted out to us to get photographs (Plate 2). The bird did three or four passes but did not land. As it did not lower its legs it was impossible to see any banding. However, the cutting edge and the greenish tip of the bill were obvious and Rohan's identification was confirmed with numerous close photos. This was an exceptional record – the first sighting for Tasmania and about the fourth or fifth for Australia.

More was to follow an hour and a half later. A New Zealand Storm-Petrel (*Fregetta maoriana*) worked up and down the berley trail in mid-distance for 10 minutes or so giving all on board good views. This bird looked similar to the surrounding Wilson's Storm-Petrels but it had heavily streaked white underparts. Unfortunately I did not catch a photo of the bird as it flew close to my side of the boat; it disappeared among the flock of similar-looking storm-petrels. Fortunately my friend J.J. (John) Harrison, who was sitting beside me, was faster and kindly gave me permission to use his photo (Plate 3). This was another exceptional record, the second only for Tasmania. The first was recorded on 31 December 2018 by Ryosuke Abe.

A Sei Whale (*Balaenoptera borealis*) that surfaced multiple times to provide good views and photos in offshore waters on Sunday morning was a first for an Eaglehawk Neck trip and, as Rohan commented, it '… would have been an early contender for "bird of the day", but is now relegated to this footnote'.

The pelagic trip of 27 February clashed with my voyage to Pedra Branca and the Mewstone, on which I also report in this volume. Paul Brooks, who led this trip, kindly forwarded me his report of the day. The highlights included the third record for Eaglehawk Neck of a White-necked Petrel (*Pterodroma cervicalis*), which made a couple of close passes in pelagic waters. Other highlights were close but characteristically short views of a Little Shearwater, a high number of 37 Buller's

Plate 3. New Zealand Storm-petrel *Fregetta maoriana* (photograph J.J. Harrison)

Shearwaters and 30 Gould's Petrels. Two Brown Skuas were unusual summer visitors.

Paul Brooks led the pelagic on 20 March, which he described as a rather quiet outing with low diversity and numbers. The 'bird of the day' was a Gould's Petrel flying past the boat on the way back to port. There were also good numbers of the Grey-backed Storm-Petrel and three hungry Gibson's Albatross sitting right at the stern – quite a treat.

The trip on 10 April was organised by Paul Brooks and led by Rob Hamilton. Due to a 20-knot north–north-easterly wind with 1- to 2-metre swell and a very choppy surface, we headed east from the Hippolyte Rocks for three stops; the deepest was at 400 fathoms before we headed back early at midday due to strengthening wind and increasing swell, arriving at Pirates Bay shortly after 2 pm. The highlights of the day were 3 Providence Petrels and 2 White-headed Petrels seen behind the boat.

Phil Peel had organised two pelagics on 23 and 24 April for a group from the mainland and kindly invited three local birders (Paul Brooks, Dale Watson and me) to come along. Paul Brooks was on the Saturday trip that enjoyed a light breeze and low swell but no birding highlights to report.

Dale and I were on board the Sunday trip; this time the seas were up to 3 metres, which brought in a few more birds. The highlights were a Brown Skua flying around the boat giving excellent views, and a juvenile White-fronted Tern.

I joined a group of mainland birding friends for two pelagics organised by Paul Brooks on 7 and 8 May. A wet and wild weather system had battered the south-east of Tasmania on the Friday prior to the trips. Due to forecast winds of 35 knots on the Saturday, that trip was cancelled and there was concern that the Sunday trip could not go ahead either. However, thanks to our skipper's skilful handling of the rough conditions, we were able to reach the shelf-break. Although there were some interesting birds around including an Arctic Tern, a Grey Petrel and a very obliging white morph of Southern Giant Petrel (*Macronectes giganteus*), the usual May specialties were conspicuously absent, perhaps because the water temperature was still a warm 17 degrees. When the wind increased to 30 knots, John Males made the wise decision to head back to shore.

On 14 and 15 May, Rohan Clarke led two BirdLife Australia trips. On the Saturday morning there was moderate to heavy rain and very low cloud and a 20-knot wind that built to 30-knot gusts at the shelf around midday before the party headed for home. Highlights were a Little Shearwater, a high count of 86 Buller's Albatross, a Northern Royal Albatross and another high count of 36 Wilson's Storm Petrels (*Oceanites oceanicus*).

The Sunday 15 May trip saw mild to warm conditions – much more pleasant than forecast – but both seabird species richness and abundance were low to very low. The highlights were 3 Brown Skuas, 47 Buller's Albatross and a Peregrine Falcon (*Falco peregrinus*) chasing a White-bellied Sea Eagle (*Haliaeetus leucogaster*) at the Hippolyte Rocks.

Karen Dick led two very quiet pelagics on 28 and 29 May organised by the Southern Oceans Seabird Study Association. Both days had low numbers of bird species. On the Saturday the highlights were 3 White-fronted Terns, 12 Gibson's Albatross and 2 Wandering Albatross (*Diomedea exulans*).

On the Sunday trip, the weather was clear and calm with a south-westerly breeze of 10 knots. The bird watching highlights included the very close views of banded juvenile Wandering Albatrosses. It was also exciting to have clear views of both forms of Cape Petrel (the Antarctic, *Daption capense*, and the Snares, *Daption australe*). A group of 6 Indian Yellow-nosed Albatross (*Thalassarche carteri*) that were floating on the sea as we approached the coast gave good views. We also saw several Sperm Whales (*Physeter macrocephalus*) and a small Humpback Whale about 10 metres from the boat. We watched an extremely tall blow that hung in the air for a long time, which Karen and others believed could only be from one of the rorqual whales: a Blue Whale (*Balaenoptera musculus*), Fin Whale (*Balaenoptera physalus*) or Sei Whale (*Balaenoptera borealis*).

John Males cancelled the pelagic scheduled for 5 June because of extreme weather but not before we had all arrived at the jetty, so Dale Watson, Mona Loofs-Samorzewski and I made the most of the day by birding on the way back to Hobart. The strong winds must have been useful for the small flock of

White-throated Needletails (*Hirundapus caudacutus*) that we saw heading north to breed, a new species for Dale. We were surprised by a group of Royal Spoonbills (*Platalea regia*) feeding along the edge of Orielton Lagoon, and by a single over-wintering Bar-tailed Godwit (*Limosa lapponica*).

The weather continued to behave badly and the forecast was horrendous for the weekend of 11 and 12 June so that Rob Morris's two pelagics were cancelled well before some of the participants flew down from Brisbane. The storm caused much damage to buildings and trees around the state and the waves out at sea would have been spectacularly high and dangerous.

On 25 and 26 June, I joined two pelagics organised and led for mainland birders by Karen Dick. On the Saturday the first highlight was 2 White-bellied Sea Eagles flying overhead at the Hippolyte Rocks. The second highlight was a very old and almost all-white Snowy Albatross (ssp. *exulans*). There were high counts of 52 Shy Albatross around the boat, 17 Cape Petrels and 17 Common Diving Petrels (*Pelecanoides urinatrix*). I enjoyed Kye Turnbull's comment that he thinks of Diving Petrels as quails of the ocean because of the way they rise up, fly along and dive down to disappear from view. We also had good views of 2 Southern Giant Petrels and 5 Northern Giant Petrels (*Macronectes halli*) close to the boat. A possible Little Shearwater seen by Louis Backstrom and me was difficult to confirm from photos because of the 20- to 30-knot wind and 1- to 2-metre seas. Janelle Walker photographed a fur seal with a large section of fishing net caught around its neck, which Karen reported to the Parks and Wildlife Service; the seal was not seen again on the Sunday.

On the Sunday we had a building sea with waves 2.5 to 3 metres high, long intervals between the swell and 20-knot winds. Highlights at sea included seeing a Southern Royal Albatross and a Northern Royal Albatross, 5 Providence Petrels, a White-fronted Tern and an Arctic Tern. Some enjoyed a very close view of a Common Diving Petrel as it erupted from the sea beside the boat. There were also large numbers of Fairy Prions and Grey-backed Storm Petrels. On the return trip to shore, 2 White-fronted Terns were spotted among a flock of Greater Crested Terns catching the afternoon sun on Cheverton Rock.

Acknowledgements

I thank the skipper, deck hands, trip leaders and report writers throughout this pelagic birding period. Thanks also to J.J. Harrison for his kind offer of the New Zealand Storm Petrel photo and to Paul Brooks for checking this article.

Bird and other species list pelagic highlights 2021–22 (IOC taxonomy v.10)

Diomedeidae: Albatross

Wandering Albatross (*Diomedea exulans*)
Gibson's type Wandering Albatross (*Diomedea antipodensis*)
Amsterdam Albatross (*Diomedea amsterdamensis*)
Southern Royal Albatross (*Diomedea epomophora*)
Northern Royal Albatross (*Diomedea sanfordi*)
Light-mantled Sooty Albatross (*Phoebetria palpebrata*)
Shy Albatross (*Thalassarche cauta*)
Salvin's Albatross (*Thalassarche salvini*)
Indian Yellow-nosed Albatross (*Thalassarche carteri*)

Procellariidae: Petrels and Shearwaters

Southern Giant Petrel (*Macronectes giganteus*)
Northern Giant Petrel (*Macronectes halli*)
Cape Petrel (*Daption capense*)
Cape Petrel (*Daption australe*)
Southern Fulmar (*Fulmaris glacialoides*)
Common Diving Petrel (*Pelecanoides urinatrix*)
White-headed Petrel (*Pterodroma lessonii*)
Providence Petrel (*Pterodroma solandri*)
White-necked Petrel (*Pterodroma cervicalis*)
Mottled Petrel (*Pterodroma inexpectata*)
Black-winged Petrel (*Pterodroma nigripennis*)
Gould's Petrel (*Pterodroma leucoptera*)
Pycroft's Petrel (*Pterodroma pycrofti*)
Cook's Petrel (*Pterodroma cookii*)
Soft-plumaged Petrel (*Pterodroma mollis*)
Blue Petrel (*Halobaena caerulea*)
Antarctic Prion (*Pachyptila desolata*)
Grey Petrel (*Procellaria cinerea*)
Little Shearwater (*Puffinus assimilis*)
Wedge-tailed Shearwater (*Ardenna pacificus*)

Buller’s Shearwater (*Ardenna bulleri*)
Short-tailed Shearwater (*Ardenna tenuirostris*)
Flesh-footed Shearwater (*Ardenna carneipes*)
White-chinned Petrel (*Procellaria aequinoctialis*)

Hydrobatidae: Storm Petrels

White-faced Storm-Petrel (*Pelagodroma marina*)
Wilson’s Storm Petrel (*Oceanites oceanicus*)
Black-bellied Storm-Petrel (*Fregetta tropica*)
New Zealand Storm-Petrel (*Fregetta maoriana*)

Sulidae: Gannets and Boobies

Australasian Gannet (*Morus serrator*)

Accipitridae: Eagles

White-bellied Sea Eagle (*Haliaeetus leucogaster*)

Falconidae: Falcons

Peregrine Falcon (*Falco peregrinus*)

Tytonidae: Barn Owls

Australian Masked Owl (*Tyto novaehollandiae*)

Laridae: Terns

White-fronted Tern (*Sterna striata*)
Commic Tern (*Sterna* sp.)

Stercorariidae: Skuas

Brown Skua (*Stercorarius antarcticus*)
South Polar Skua (*Stercorarius maccormicki*)
Long-tailed Jaeger (*Stercorarius longicaudus*)

Ardeidae: Herons and Bitterns

Great Egret (*Ardea alba*)
Royal Spoonbill (*Platalea regia*)

Scolopacidae: Godwits

Bar-tailed Godwit (*Limosa lapponica*)

Apodidae: Swifts

White-throated Needletail (*Hirundapus caudacutus*)

BALEEN WHALES: Order Mysticeti

Rorquals: Family Balaenopteridae

Sei Whale (*Balaenoptera borealis*)

Fin Whale (*Balaenoptera physalus*)

Blue Whale (*Balaenoptera musculus)*

Humpback Whale (*Megaptera novaeangliae*)

TOOTHED WHALES: Order Odontoceti

Sperm Whale (*Physeter macrocephalus*)

JELLYFISH: Order Semaeostomeae

Lion’s Mane Jellyfish (*Cyanea capillata*)

Book and website reviews

Websites for Tasmanian naturalists

Reviewed by Robert Mesibov

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Websites are an alternative to printed identification guides and have several advantages over books. The most important was offered by Simon Grove on his *Molluscs of Tasmania* site (described below):

> Because molluscan taxonomy is in a continual state of flux, and because our understanding of what species occur in Tasmania is advancing all the time, a paper publication on this subject rapidly becomes outdated as new species are discovered, new names and taxonomic relationships are introduced and old ones invalidated. These web-pages are designed to avoid the fate of a paper publication by being amenable to regular updating.

A second advantage is easy access to related resources. A book might refer you to another book, which then needs to be purchased or found in a library. On a website, linked online resources are only a click away.

A third advantage is price. When you buy a natural history book, you are paying to add the book to your growing library; it's a marginal cost. If you have already paid for your internet connection, there is no *additional* charge for accessing natural history websites.

A fourth advantage is available to smartphone users in the field, assuming there is mobile coverage at the field site. You may not need to carry books in your backpack: identification guides are on your phone, either as websites or apps. The latter include the *Field Guide to Tasmanian Fauna* (Tasmanian Museum and Art Gallery; iOS and Android) and a range of Australia-wide identification apps covering selected taxa.

In this article I briefly describe eight websites (not apps) which provide illustrated identification guides to our native biota and are Tasmania-specific. Details are current as of 1 June 2022, and I am grateful to the publishers of these sites for background information.

TasFungi

https://www.tasfungi.com.au

Images of identified Tasmanian fungi (and some slime moulds) with a high-level key based on form or habit. The site is administered by Heather Elson, Charlie Price and mycologist Genevieve Gates, who write:

> The Tasmanian Fungi website is a not for profit online resource for sharing information on the identification, ecology and taxonomy of fungi (more specifically Tasmanian fungi), including Slime moulds (Myxomycota), and on the application of this knowledge for the cultivation, remediation, medicinal and other roles they play in our culture. This website was created as a backup to the TasFungi Facebook group created

by Dr Genevieve Gates, and arose from feedback from those wanting information, but not wishing to use social media. It has the same aims of linking the general public and citizen scientists, with qualified mycologists and fungi events.

First online in 2014 and privately funded by the maintainer.

***

Tasmanian Myxomycetes

https://sarahlloydmyxos.wordpress.com

This website contains images by naturalist Sarah Lloyd, OAM of ca 120 slime mould species from Black Sugarloaf in northern Tasmania, together with a key to myxomycete orders and detailed information about individual species. A glossary page is illustrated with annotated images. First online in 2017; 30+ pages and hundreds of images. Hosted without charge by wordpress.com.

***

Key to Tasmanian Vascular Plants

https://www.utas.edu.au/dicotkey

This website consists of image-based keys to the flowering plants, conifers, ferns, liverworts and mosses of Tasmania. The keys use readily apparent characters, illustrated with thumbnail images that can be individually enlarged. Endpoint pages in the keys (usually species or genera) include descriptions and notes on biology and distribution. There are botanical references on an acknowledgements page, and a separate section (linked to the endpoint pages) for common names of plants. The website is maintained by botanist Greg Jordan and hosted by the University of Tasmania. First online ca 2007; ca 11,000 pages and ca 4,200 images covering 2,000+ taxa.

***

Molluscs of Tasmania

https://molluscsoftasmania.org.au

This website is an illustrated guide by Simon Grove and Rob de Little to the marine molluscs of Tasmania, but without a key and without images for some Tasmanian species. A particularly useful section of the site lists Tasmanian coastal localities; one can go to a locality to see thumbnail images of species recorded there. Species pages have close-up images, descriptions and a localities map. The site also has a search function for genus and species names. Funded by the Tasmanian Museum and Art Gallery. First online ca 2006; ca 2,900 pages and ca 4,000 images covering ca 1,400 species.

***

Field Guide to the Insects of Tasmania

https://tasmanianinsectfieldguide.com

This website is an illustrated guide by amateur entomologists Kristi Ellingsen and Tony Daley that first went online in 2012 and was upgraded in 2021 by Yoav Bar-Ness. Although the site lacks detailed keys, navigation through the insect orders is made easy by image galleries ('visual finders'). Endpoint pages have localities and dates for images of individual species. There are separate pages for the non-insect hexapods (Collembola, Diplura, Protura). Privately funded by the maintainers; ca 3,900 pages and ca 43,000 images covering 1,000+ insect species.

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Tasmanian Spiders

http://www.tasmanianspiders.info

This illustrated guide was created by spider enthusiast John Douglas, who writes:

> This website has been made to fill a need for information on spiders found in TASMANIA. It is intended for the amateur enthusiast and members of the general public trying to find a name for a spider they have found. It is not intended to be a comprehensive scientific document as much of the information on spiders is hard to source and is of a dynamic nature, changing often as new scientific research is carried out.

The site has spider images by Douglas and others, and separate pages for information on venoms and spider anatomy. First online in 2008, privately funded by the maintainer; ca 650 pages and ca 3,100 images covering ca 350 species.

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Tasmanian Millipedes

https://www.datafix.com.au/tasmanian_millipedes

Illustrated keys, species images and descriptions, locality maps and references for 138 native and 8 introduced millipede taxa can be found on this website, which is privately funded and maintained by myriapodologist Bob Mesibov. First online in 2003 (as part of the *Tasmanian Multipedes* website); 269 images and 140 maps on 38 pages.

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Fauna of Tasmania

https://nre.tas.gov.au/wildlife-management/fauna-of-tasmania

This is a state government website with 'fauna' restricted to Tasmanian birds, mammals, reptiles and frogs. No text or image keys are provided and most species do not have endpoint pages with images and detailed information, but some bird and frog pages have audio files with calls. It isn't clear when the pages were first online; a Department of Natural Resources and Environment spokesperson suggested 'many years ago (c. 20 years??)'.

*****

A Guide to the Land Snails of Australia

by John Stanisic, Darryl Potter & Lorelle Stanisic

CSIRO Publishing, 2022

Paperback, 172 pp

ISBN 9781486313525

Reviewed by Kevin Bonham

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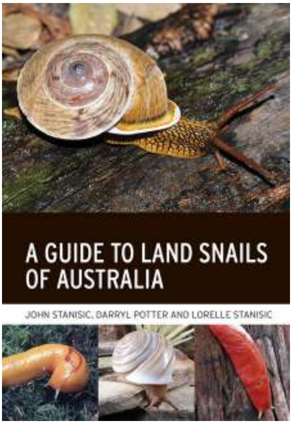

Until 2010, there was a pressing lack of modern identification guides to the Australian native land snail fauna. In that year, John Stanisic and colleagues published *Australian Land Snails Volume 1. A field guide to eastern Australian species* (Bioculture Press). This was followed in 2018 by *Australian Land Snails Volume 2. A field guide to southern, central and western species* (also Bioculture Press). Although some sections of Volume 1 are now substantially out of date, these books are essential for anyone seeking to identify Australian land snails to the species level. However, their price tag (around $100), large size and the fact that they spread the fauna across two volumes means they are not ideal for someone seeking a more casual introduction.

This new guide seeks to provide a popular overview of the fauna and the study of Australian land snails. It includes general sections on snail form and function, land snail behaviour, snail ecology and conservation, finding and collecting snails, and human uses of snails. There is a brief history of the study of Australian snails. The book's core sections provide an overview of Australian snail identification, family-by-family guides to the native and introduced snail fauna, and a regional tour of local land snail faunas.

The book is written in a lively, enthusiastic fashion and overall does an excellent job of picking out highlights and general features of the fauna from the far greater volume of information in the two previous guides and elsewhere. There are many very high-quality photos with a strong emphasis on showing live animals at full stretch and not just their shells, though those wanting the full impact of these photos should seek out the field guides where many of them appear in a larger format. Now and then, more information about the specimens photographed would have been useful (including when they are immature specimens, as with *Arion ater* on p. 13 and *Caryodes dufresnii* on p. 107). 'Key localities' are provided for each species, which seem arbitrary to an expert eye in the case of species that are common and widespread, but which are likely to prove very useful to general observers who would like to find and admire a notable species for the first time.

As usual with guides in this series, coloured text boxes are used to cover particular themes, for example 'The Giant African Snail', 'The Ningbing camaenid radiation' and 'Limestone and land snails'. In this book, these special sections sometimes stretch across four or five pages, and they all do a fine job of highlighting special features of the fauna and the study thereof.

Some errors do occur. On page x, the Cystopeltidae are said to have four species when five were recognised in the 2010 and 2018 volumes; likewise on p. 75 the genus *Austrosuccinea* is said to have three species when the previous volumes included four. (The description of *Austrosuccinea* as 'endemic to the mainland' may also cause confusion among those who use the term 'mainland' in a context that excludes Tasmania rather than a context that excludes Christmas, Lord Howe and Norfolk islands). *Rhagada torulus* (Ferussac, 1819) is described prominently as the first described Australian land snail (pp 1, 111), but *Caryodes dufresnii* (Leach, 1815) was published earlier. The slug *Testacella haliotidea* is described as common in Melbourne and Hobart (p. 82) but it is most often recorded around Sydney and I am not aware of any Hobart records in recent decades.

There are also some cases of outdated or incomplete information. The Keeled Carnivorous Snail is figured as *Tasmaphena lamproides* (p. 106) but was transferred to *Austrorhytida* in the 2018 volume. *Cucullarion parkini* is said to be endemic to Mount Tamborine (p. 98), but a Lamington National Park record was published in a paper by Hyman et al. (2017) referenced in the book (and there have been other non-Tamborine records). At least two families are missing from the list of introduced species, namely the Lauriidae (as seen in last year's *Tasmanian Naturalist*!) and the Discidae (though the two records of *Discus rotundatus* from Melbourne so far are not formally documented). I also noticed the use of the generic names *Meridolum* (synonymised with *Sauroconcha* by Köhler and Bouchet (2020) and *Dimidarion* (synonymised with *Fastosarion* by Hyman and Köhler in 2019) but am unsure if these represent oversights or differences of taxonomic opinion.

I was surprised to see an illustration of the 'Pink Mount Kaputar Red-triangle Slug' captioned as *Triboniophorus graeffei* on p. 100 as the Mount Kaputar population is generally considered to be undescribed. Indeed, the book often (but not always) shies away from mentioning known undescribed species. The presumed-extinct *Occirhenea georgiana* from south-western Western Australia is called the 'only local species of rhytidid' when a second, extant, undescribed species of *Occirhenea* was referred to in the 2018 field guide.

As is far more likely when trying to pack so much information into a relatively concise book, there are some overgeneralisations. Perhaps the most material of these is the claim on p. 33 that 'The effect of exotic snail and slug species [on native land snails] appears to be minimal as these are chiefly confined to urban areas and farmlands where native species tend not to occur'. Predatory and invasive *Oxychilus* species are recognised as a significant threat to entire native land snail species in south-eastern and south-western Australia, an issue that is later mentioned in the case of *O. alliarius* in southern WA (p. 84) but in a way that may be read as implying only a risk of local extinctions.

Finally, and since this is a review for a Tasmanian-centred audience, the Tasmanian coverage in the regional fauna section could be better. Something called the 'Franklin-Gordon World Heritage area' is declared to be a 'major land snail hotspot' alongside the north-east and 'The Tarkine', although there is no basis for declaring any of these areas to be hotspots without declaring the south-east to contain one or more hotspots as well. (Really, the 'hotspot' concept does not work very well for snails in Tasmania.) Later in the book, both the 'Tarkine' and 'Franklin-Gordon' areas are called 'largely unexplored for land snails', a claim that has not been true for the Tarkine at least for many years, especially not after the 10-day ABRS Bush Blitz in 2015. Unfortunately, this claim unwittingly plays into a more general tendency for the Tarkine to be romanticised as under-surveyed, despite the large number of scientific expeditions that have been there, and when less glamorous but potentially more threatened habitats (for instance surrounding the Midlands) are in greater need of surveys.

The above criticisms should be considered a note of caution against taking everything in this book for granted, but not against regarding it as an excellent introduction to the fauna overall. This book is likely to spark greater interest in our land snail fauna, and is very good for those seeking to learn more about snails and even to start researching them.

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Beetles: An Illustrated Checklist of the Insects of Tasmania. Part 1 – Coleoptera

By Simon Grove, Lynne Foster & Nick Porch

The Royal Society of Tasmania, 2022

Softcover, 110 pp

ISBN: 9780645314106

Reviewed by Keith Martin-Smith

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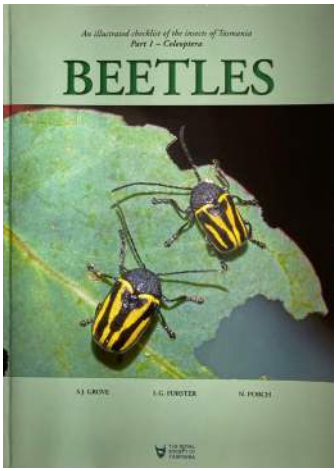

'An inordinate fondness for beetles' – this was how the famous scientist J.B.S. Haldane replied when asked if there was anything about God that could be concluded from the study of natural history. While some recent studies challenge the assertion that beetles are the most speciose insect order in favour of parasitoid wasps, it is certainly true that beetles are incredibly diverse. Tasmania is no exception to this rule, with more than 2,800 described species, including over 600 endemic species that are found nowhere else on the planet.

Simon Grove and Lynne Foster will be well known to many members of the Tasmanian Field Naturalists Club, while Nick Porch would be similarly well known to Victorians. They have used their enormous, combined knowledge to produce this checklist of all of the currently described beetle species of Tasmania, including Macquarie Island. This is a monumental undertaking and they should be heartily congratulated for their hard work and dedication in putting the book together.

The introduction briefly describes the history of beetle taxonomy in Tasmania from the first published work in 1842 to the present day. Interestingly, the rate of description of new species has slowed down considerably since the 1930s – whether this represents a true plateau or a lack of interest by government in funding taxonomic research is not known! A more recent uptick in identification of new species due to novel genetic techniques leaves the authors in no doubt that many species remain undescribed.

A summary of the numbers of families, species, endemic species and introduced species (147) is followed by a brief discussion. The main part of the book is composed of the checklist itself, organised by family in evolutionary order, with each subfamily and tribe within the family presented alphabetically. The common name for each family is given together with a brief description of its key characteristics and ecology. Representative plates of species from most tribes, subfamilies and families are provided in the middle of the book.

This is not a field guide that will help with a casual beetle identification, but it is a comprehensive and up-to-date catalogue of the beetles of Tasmania. Beetle enthusiasts will want a copy and it is an invaluable resource for anyone undertaking beetle research in Tasmania.

*****

A Complete Guide to Native Orchids of Australia

By David Lloyd Jones

Third edition

New Holland Publishers, 2021

Hardback, 800 pp

ISBN: 9781921517709

Reviewed by Bruno Bell

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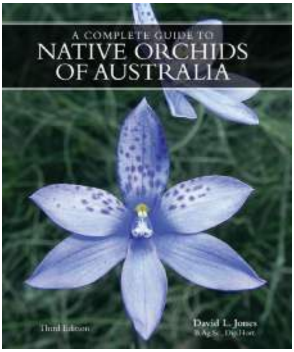
The third edition of *A Complete Guide to Native Orchids of Australia* is a very comprehensive treatment of native



orchids of Australia. It provides detailed descriptions of 1,698 species, including 203 Tasmanian species. Notably this is down from around 216 species previously considered for Tasmania because of recent taxonomic research.

Each species section includes a detailed scientific description, habitat description, distribution map, flowering time, similar species, conservation status and additional notes on the species. These are accompanied by beautiful pencil illustrations and photographs of each species and its diagnostic features. Additionally there are helpful flower anatomy diagrams, for notable groups.

Much of the research into Australian native orchid taxonomy has been led by David. L. Jones, who has spent a lifetime in this field. However, Australian native orchid taxonomy is still unsettled, particularly in certain groups such as *Thelymitra* (Sun Orchids) and *Caladenia* (Spider Orchids). DNA techniques will continue to throw further light on taxonomic issues. In some instances I have found it difficult to determine the difference between the species Jones recognises.

Nevertheless, *A Complete Guide to Native Orchids of Australia* is suitable for both amateurs and experts alike, with its detailed scientific descriptions, illustrations and photographs, as well as a straightforward layout. Compared to the previous editions, this third edition has more detailed and clearer layouts and places a greater emphasis on conservation. The introduction in particular is very helpful in providing extensive background reading on orchid biology and structure. In addition, further reading resources are provided. The book is certainly comprehensive; however, at a costly $270 and lengthy 800 pages, it may not be in everyone's budget range and is certainly not suitable for use in the field. Overall, I would highly recommend this book as a reference to enthusiasts with a keen interest in Australian native orchids.

*****

Hold On! Saving the Spotted Handfish

By Gina Newton
Illustrated by Rachel Tribout

CSIRO Publishing, 2020

Hardcover, 33 pp

ISBN 9781486311842

Reviewed by Louise Brooker

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We all know about this quirky, primitive little fish that lives only in the waters of the River Derwent and the D'Entrecasteaux Channel. Well, it is the subject of a book published by CSIRO

in 2020 aimed at primary school–aged children.

Hold On! Saving the Spotted Handfish is the title given to this book by its author Gina Newton, a scientist and science communicator. Though classified as non-fiction, it presents the facts by weaving them into a narrative told by the main character, Handstand. That might sound vacuous, but I think it works well. The story is told in the first person to impress children and makes both the character and the facts more memorable and believable.

The blurb on the back cover is sure to lure potential readers. It asks, 'Have you ever seen a fish that could do a handstand? The Spotted Handfish has survived since the time of the dinosaurs, until now. Raise your hand if you want to know more.' This little fish has more going for it than the fact it was on earth in the time of the dinosaurs: the fact that it's been touted as the most endangered fish in the world, for one. That's sad.

The book is a successful collaboration between the author and the illustrator, Rachel Tribout. Many different techniques are used to present the facts. Alongside the illustrations, there are speech bubbles, words written in large and bold type, diagrams with labels, lists, maps and keys for their interpretation. 'Reading' and interpreting these are important skills in becoming literate and specifically taught as part of the primary school curriculum now. There is a conservation timeline beginning with the 1960s, when the handfish was so common it was used in zoology classes to practise dissection, and ending in 2020 with the establishment of a captive breeding program. There is so much detail in the illustrations that kids will find something new each time they dip into the book.

The author does not shy away from using the correct scientific terms. She uses and explains words like *evolved*, *extinct*, *crustaceans* and *plankton*; there is mention of the IUCN Red List and a vulnerability checklist. All terms and concepts are explained carefully, thereby extending children's vocabulary. A very thorough glossary is included at the end of the book.

If the use of all this scientific language sounds a bit dry and perhaps a little daunting, not to worry, for it is balanced beautifully with the use of modern idioms and colloquial language that will definitely appeal to a young audience. Being a walking fish is so cool!

I'm not aware of any other such storybooks about the marine environment that showcase the biology and ecology of an endangered species this way. It shows how important science and the gathering of data is to conservation. A book like this just may steer a child towards an appreciation of these issues and into science studies.

Indeed, mention is made also of the role of citizen scientists in gathering data.

I bought this book to read to my grandchildren. Not only did it tell us the story of the threats to the spotted handfish, its unusual method of reproduction and the efforts being made to recover its numbers and protect its habitat, but the unexpected happened: it whetted my own appetite to learn more about it. Since then, I've read an interesting post on the CSIRO webpage titled 'Spotted Handfish: Walking towards Recovery'; a little while ago, I noticed a story in a newspaper about some people who returned to the water a stranded handfish they had found on Nutgrove Beach, and I recently heard an interview with Jan Bamford, who is making ceramic breeding posts for an artificial spawning habitat program in aquaria.

Sharing this book has added greatly to my curiosity about the fortunes of Hobart's iconic fish.

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:

https://tasfieldnats.org.au/naturalist/

Any individuals or organisations seeking to support the Tasmanian Field Naturalists Club Inc. through sponsorship of its annual scientific journal, should contact the Editor in the first instance. All sponsors are acknowledged in the Editorial Note at the beginning of the issue and in this sponsor statement (usually with a link to the sponsor's website), and receive hard copies of the journal for their own promotion.

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, website 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 editor@tasfieldnats.org.au or to the Club's address. Contact the Editor 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). All articles will be reviewed by the editors and/or external referees. Responsibility for accuracy and currency of taxonomic nomenclature rests with the author(s). The editors use the *Macquarie Dictionary* and *The Style Manual for Authors, Editors and Printers* as standard reference texts. It is important to refer to the Guidelines for Authors, available on the Club's website at www.tasfieldnats.org.au/naturalist/.

Submissions should be provided electronically in standard text files. Images, tables and diagrams should be submitted in separate files. They must 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

GPO 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; please check the website for details of the venue. 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:

https://www.tasfieldnats.org.au

Membership rates

Adult	$30
Family	$35
Student/Concession/Pensioner	$25

Subscription rates for *The Tasmanian Naturalist*

Australia	$25
Overseas	$30

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