fungimap newsletter **60**

December 2019

AUSTRALIA'S FUNGI MAPPING SCHEME

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Coordinator's Report

Cameron Durnsford

It has been another big year of change for Fungimap, with new technologies vying for our attention, new species being discovered on our shores and several other changes within Fungimap's committee and staff. I come to the role with experience in non-profit project management, most recently in community broadcasting. I'm discovering many parallels and synergies in the world of citizen science – an impassioned, committed volunteer base being the most apparent!

My interest in the natural world led me to return to study a Master of Urban Horticulture at the University of Melbourne's Burnley Campus this year – like most fungi fanciers I was aghast to learn how few opportunities there are for mycology study in this country … fortunately my mycological education through my work as Fungimap coordinator has been swift. It is a great honour to be in the role, continuing the great work of previous coordinator Sapphire (more on that in a moment) and the committed team of volunteers across Australia who've contributed to this great project over many years.

Looking forward to the future, I am encouraged by the way new technologies are set to shape the next phase in Fungimap's work. In my short time in the role we've seen a rapid uptake of the iNaturalist app as a quick and easy means of submitting observation records – to my mind, one of the best outcomes of the ever-pervasive role smartphones play in our lives. We've shared some information about how to get started on the Fungimap blog here: https://fungimap.org.au/moving-to-inaturalist-for-fungimap-records/, but you can always reach out to us here if you need a hand getting up and running. With the recent launch of iNaturalist Australia in partnership with the Atlas of Living Australia (ALA), much of the data wrangling involved with adding records to our national biodiversity portal has been streamlined significantly.

For those of you who still prefer submitting your records by other means, fear not: your contributions are still welcome, and will be thoughtfully attended to by our expert IDs team as before. We were fortunate to recently receive a grant from the Field Naturalists Club of Victoria's Environment Fund to help us with the work of getting these observation data into the ALA. With this small project we'll be able to catch up on getting our records to the ALA in a timely fashion, and clean up our existing data, which play an important role in research and conservation of our wonderful and unique mycota. We saw this in action in July this year, when Fungimap observations were used to support threat assessments carried out at the Australasian Fungi Red List Workshop held in Melbourne.

We hope to see a number of our rare and threatened fungi receive the protection they deserve as a result of this workshop; watch our website and social media in the coming weeks for details. As this will be our only newsletter for 2019, we encourage you all to visit the website and sign up for our eNews for more regular updates on all things Fungimap: https://fungimap.org.au/get-involved/subscribe/

Finally, a big thank you to Sapphire McMullan-Fisher for making my transition into the role as smooth as possible. Despite finishing at the end of last year, having Sapphire here in her role as Fungimap Mycologist working on the ***Putting Victoria's Fungal Diversity on the Map*** project, has been invaluable.

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Fungimap Committee

Why your support of Fungimap is so important

Fungimap is a national not for profit organisation dedicated to advancing knowledge and conservation of Australian fungi, with a focus on (but not limited to) macrofungi. Fungimap relies upon memberships and donations to carry out its work.

Fungimap aims to:

- Stimulate and support the study of Australian macrofungi through the accumulation, storage, analysis and dissemination of information about fungi
- Promote the appreciation of fungi with a focus on Australian macrofungi in the natural environment
- Link and bring together those with an interest in Australian macrofungi, providing opportunities for sharing and learning; and fostering relationships between groups and individuals that share the objectives of Fungimap; and
- Foster the conservation of Australian macrofungi.

Fungimap Membership 2020

Full Member $55
Concession $45
Household $65
Group & Library $55
All donations over $2 are tax deductible

President's Report

Roz Hart

We have now moved over to communicating via eNews which is regularly getting the Fungimap message out to many more fungi supporters, but newsletters still have their place for more detailed information. I do hope you enjoy reading this newsletter and look forward to your contributions of anything fungal – we really do need content to be able to produce newsletters.

I'd particularly like to draw your attention to what's been quietly happening over the last few years with iNaturalist and how Fungimap is contributing to building up Australia's bank of fungi data. Julie Fielder saw the beauty, simplicity and possibilities of electronic gathering of fungi photos with the associated embedded location data. This became possible once the quality of phone camera photos improved, and so many of us moved to using our amazing personal computer that we still call phones – well "smartphones" – as cameras. This has the extra bonus that whenever you see a fungus you don't have to rush home for the camera, it's with you!

Julie set up the Fungimap Australia project within iNaturalist, a global natural history system with both App and web-based platforms. Many people share their fungi photos on social media; while engaging, this sadly does not contribute to our long-term understanding of Australian fungi. If you share your iNaturalist record on social media the identification gets updated as confirmation happens.

Fungimap wanted to test this system, so Paul George, Tom May and Graham Patterson worked with our naturalist recorders and identifiers. Thanks to everyone who helped us build our project for the first two years before members were invited and encouraged to use it.

A little over a year ago Fungimap recommended to members that they use the iNaturalist Fungimap Australia project. This opened up the possibility of a lot more records entering the Atlas of Living Australia (ALA) for a lot less effort. The ALA is our national biodiversity amalgamation tool that allows searching for records, images, and identification materials, so iNaturalist was seen as an addition to the tried-and-true method of recording fungi data: photos and associated important information are sent in to the Fungimap ID team, and where a positive ID can be made, records are submitted to the ALA. By getting fungi records entered by iNaturalist into the ALA, Fungimap is helping verify and gather data about Australian fungi. We hope this data will be used to better understand our local fungi and ensure that they are factored in to conservation planning.

We can now report that just over 19,000 observations of 769 different fungi species have been entered into the iNaturalist Fungimap Australia project, by 146 recorders as of 5 December this year.

Just under 7,000 of these observations have been verified (i.e. the identifications confirmed by at least two people) and deemed 'research grade' and therefore eligible to go into the ALA.

Fungimap's ID volunteers, principally Graham Patterson and Tom May identify both the records that are directly sent to Fungimap and also, increasingly, those submitted via the iNaturalist project. Tom has confirmed nearly 2,000 of the iNaturalist Fungimap records, and other prolific identifiers include Reiner Richter and even several people from overseas, including John Plitschke and Petra Gloyn. It's important to realise that not all fungi photos can be identified – the quality control applied by checking images is an important process and we should never expect that all records will reach research grade.

The great news is that under the Fungimap Australia project, of these 18,994 observations:

- 6,945 were verified to research grade
- for 487 fungi species
- confirmed by 242 identifiers
- recorded by 109 observers

For observations to be included in the Fungimap iNaturalist project, these observers supplied some extra important data: information about both habitat and substrate. We still know very little about the biology of Australian fungi so knowing, for example, that the observation was in a parkland but on a log, gives us more information about the fungus. If you are a collector of fungi you can also record details of any collections associated with an iNaturalist record, so that records can be cross referenced to data available in the Australasian Virtual Herbarium (https://avh.chah.org.au/).

Some 36% of fungi observations entered in our project have reached research grade since it started. This is superb confirmation that using iNaturalist is a much more productive and easier way to gather information about Australian fungi. You can look on iNaturalist yourself and get up-to-date information at https://www.inaturalist.org/projects/fungimap-australia.

So, if you haven't tried it you should have a go. For those wonderful recorders who have been communicating with Graham and Tom as the Fungimap ID team, thank you, and for now our old systems are still also working.

Fungimap thanks long-serving volunteers Paul George and Christina Hall

Paul George photographing fungi in Tasmania (Katrina Syme).

Thanks Paul

Paul George stepped down as Secretary of Fungimap at the AGM earlier this year. Paul submitted his first record to Fungimap in 2001, and in his words "I was hooked. I'd found a forum to share my photos, expand my knowledge and meet some wonderful friends along the way".

Paul joined the Fungimap management committee in 2005, at the time Fungimap became incorporated. Over more than a decade, Paul attended every one of the usually quarterly committee meetings, dealing efficiently with agendas and minutes, and making sure that the paperwork required for an incorporated organization was completed and lodged. Just as importantly, Paul brought his passion for fungi and his experience from former roles in the IT business to discussions about the whole range of issues dealt with by the Fungimap committee.

Paul's long term interest in fungi photography meant that he was often out in the field and well-connected to fungi enthusiasts on the ground, and could bring that direct experience to discussions about strategies for Fungimap. Paul also actively participated in many of the Fungimap Conferences and expeditions. We look forward to many more observations in the iNaturalist Fungimap project from Paul now that he has a little more free time!

Thanks Christina

Christina Hall recently stepped down as editor of the Fungimap Newsletter. Christina took on this role in 2011, producing Newsletters 44 to 59. The Newsletter is laid out in a word processing program, which can be quite challenging when putting together many articles, of different lengths, along with images and captions; as well as last minute additions as new planned activities are included. Authors and proof-readers are scattered around the country, and often several proof versions needed to be produced, as names of fungi, places and people were double checked. Christina always made sure that all changes were made, and very efficiently delivered the print-ready versions for the Fungimap Coordinator to arrange for printing.

For much of her time as Editor, Christina has worked as Communications Officer at Melbourne Bioinformatics, and the Fungimap editing has been done in her own time as a voluntary contribution. When Fungimap members are asked what they value about Fungimap, the Newsletter always features high on the list. Christina produced 15 of those Newsletters, full of interesting and well-laid outcontent.

Behind-the-scenes roles like the Secretary and the Newsletter Editor make a big difference to the running of Fungimap and the experience of members. We'd like to thank Paul and Christina for all their efforts over the years, and wish them all the best with their current activities.

Poison Fire Coral *Trichoderma cornu-damae*

Ed Grey

(A similar article was published in the Field Naturalists Club of Victoria Newsletter, Field Nats News No. 303 - reproduced with permission)

Trichoderma cornu-damae (Ray Palmer CC-BY-SA).

This red, club-like fungus, originally discovered in China in 1895 and found in Korea, Japan and the Java Islands, has recently been seen at Redlynch Valley in suburban Cairns, far North Queensland. It has been the subject of several media releases. According to Dr Matt Barrett from James Cook University (JCU): "This record extends the distribution of the fungus considerably, and it may even be more widespread in tropical Australia". Dr Barrett confirmed the identity of the deadly Poison Fire Coral fungus after local photographer Ray Palmer provided an image of a mystery fungus snapped in Cairns. He had first found it in 2016.

The bright red Poison Fire Coral fruit bodies were found on tree roots and soil. Dr Barrett warned people to resist the urge to pick up the eye-catching fungus as its toxins may be absorbed through the skin. Without a known cure or treatment, several fatalities have been recorded over the years in Japan and Korea, especially from people mistaking this fungus for an edible mushroom (e.g. *Ganoderma lucidum*) and consuming it directly or as an infusion. The poisons are trichothecene mycotoxins, including satratoxin h, roridum e and verrucarin, which attack vital organs in the body such as liver and kidneys.

The species resembles a coral fungus but belongs in the family Hypocreaceae. It was originally named *Hypocrea cornu-damae* Pat, then *Podocrea cornu-damae* (Pat.) Sacc. & D.Sacc., and is currently known as *Trichoderma cornu-damae* (Pat.) Z.X. Zhu & W.Y. Zhuang. The fruit-body is upright, simple or contorted, smooth and red (Fig. 1 and 2) and grows to 100 mm tall, but is usually smaller (40 mm). The club tip is tapered and there is no stem. The spore print is yellow to brown. Its habit is clustered, and the substrate is dead wood, especially tree roots.

While Poison Fire Coral *Trichoderma cornu-damae* is a tropical fungus and not likely to grow in Victoria, we should be on the lookout for it. The Flame Fungus *Clavulinopsis sulcata* (a true coral) usually has simple clubs, but contorted forms as in Fig. 3 and Fig. 4 could be mistaken for *T. cornu-damae*. However, C. sulcata does not grow on wood, but in the ground and has a white spore print. Note also this fungus is a basidiomycete whereas T. cornu-damae is an ascomycete.

Putting Victoria's fungal biodiversity on the map

Dr Sapphire McMullan-Fisher (Fungimap Mycologist)

With the support of the Victorian government, Fungimap has been able to increase data about fungi by encouraging the mapping of fungi, as the project title above suggests. This is being done in two ways – firstly, by improving the community's ability to identify and record recognisable fungi, which helps achieve the second aim: to learn more about likely rare and threatened fungi – those we are calling 'lost fungi'.

Fungimap has rolled out training workshops across most of Victoria in the last two years. These workshops have helped local communities get to know their more common, recognisable fungi using regional kits (these kits can be downloaded from the project website https://fungimap.org.au/cva-project/). Workshops have also provided training in how to use the identification capabilities of the iNaturalist application. Fungimap has an Australia-wide project in the identification and biodiversity recording tool iNaturalist (https://www.inaturalist.org/projects/fungimap-australia). When making an observation on iNaturalist, observers can make use of the "Suggest an Identification" recognition algorithm. Then, observations are confirmed by a community of naturalists who know the local fungi. Verified, so-called 'research grade' records are harvested by the Atlas of Living Australia and contribute to our understanding of Australian biodiversity.

Cleaning shoes to protect bushland to be surveyed (Emily Noble)

During the field surveys we were particularly impressed with the care taken by Ballarat Environment Network and the Field Naturalists' of Ballarat when we surveyed one of their reserves (Fig. 1). Going clean and dry to sites of conservation value is important for protecting our bush from known and unknown pests and weeds whether they be fungal, animal, plant, protozoa, bacterial or viral. The picture below shows cleaning shoes, which is important to prevent the spread of soil-borne pests and helps protect our bush. Arrive with clean and dry clothing and equipment, including footwear, hats, bags, resting mats, and anything that moves between sites. People are the most effective dispersal agents on the planet!

The second focus of this project has been to increase data for likely rare and threatened fungi or as we call them 'lost fungi'. These uncommonly recorded fungi need our attention because

A new population of ***Auriscalpium*** sp. "Blackwood" has been found at Olinda in the Dandenong Ranges east of Melbourne. (Reiner Richter CC-BY-NC-SA)

they are less commonly seen. We know less about their biology and distribution; names and taxonomy are often still uncertain.

Fungal conservation has been in the wind this winter with the Australasian Fungi Red List Workshop held in Melbourne at Royal Botanic Gardens Victoria in July https://www.facebook.com/groups/rbgvscience/permalink/1182011025324169/. At this Workshop, fungi were assessed for inclusion on the IUCN Red List of Threatened Species. We are delighted that some of the lost fungi had their conservation status assessed – most for the first time. We just got word from the IUCN team that assessments for 12 Australian species will be published soon. Species assessed included: ***Amanita elongatospora,*** Vermilion Grisette (***Amanita xanthocephala***), Stemless Earpick (***Auriscalpium*** sp. 'Blackwood'), Beenak Long Tooth (***Beenakia dacostae***), ***Bondarzewia retipora, Cyttaria septentrionalis, Heimioporus australis, Humidicutis arcohastata, Hygrocybe boothii***, Tea-tree Fingers (***Hypocreopsis amplectens***), ***Melanoleuca clelandii***, and Wombat Fleshtooth (***Sarcodon*** sp. 'Wombat') (species in bold are on our current lost fungi list). If you would like to know more about the Wombat Fleshtooth read James' article at the end of this Newsletter and see the profile page http://iucn.ekoo.se/iucn/species/1000205/. We have started uploading the lost fungi profiles starting with the lost lichens on our website. This information is also available as a downloadable and printable pdf.

One of the species assessed was Stemless Earpick (***Auriscalpium*** sp. 'Blackwood') http://iucn.ekoo.se/iucn/species/1000204/. This unusual tooth fungus had been found semi-regularly for the last two decades by the Field Naturalists' Club of Victoria fungi group members and local fungi enthusiasts on the same tree, a narrow-leaved peppermint (***Eucalyptus radiata***) at Blackwood. Reiner, a mega-enthusiastic naturalist found a new population near Olinda in the Dandenongs, once

Greg Mueller is looking at the piece of wood with the tags on it – the fruit-body on the ground (Tom May CC-BY).

again only on the buttress of a single narrow-leaved peppermint tree.

At the Workshop, Tea-tree Fingers (*Hypocreopsis amplectens*) http://iucn.ekoo.se/iucn/species/531280/ was also assessed and despite a new population being found a few years ago, the ongoing absence over the last three years during surveys at Greens Bush suggests that it is now extinct at this latter site. It was incredibly lucky that the Grantville Tea-tree Fingers populations survived the fire in February 2019. One population was within 50 metres of the fire, and survived the fire management disturbance as well as escaping being burnt!

Both the Stemless Earpick and Tea-tree Fingers were visited by the team in Melbourne for the Red List Workshop. These visits contributed to improved understanding of the biology of these species, including confirmation of the host tree of the Olinda population of Stemless Earpick.

In August, participants braved snow to help with the lost fungi workshop held by Fungimap in central Victoria. This workshop was kindly hosted by Bronwyn Silver in the vintage Old Walmer School. Participants who are already regular observers of their local fungi were brought together to learn more about the more complex task of recording both rich observation data and lost data (or absence data). People brought their knowledge of their local fungi and their field survey experience. We used some of their data to upload examples live to the Biocollect project 'Lost Fungi Australia'. After a delicious morning tea, eight brave participants braved one of the coldest winter days to make a start on uploading some of their data. Unlike iNaturalist, Biocollect projects will accept absence or 'zero' data, which is equally important for conservation of small populations. Questions about how to best record data helped improve the Biocollect project and there is more data here about how to share the most information https://fungimap.org.au/fungi-down-under-100-target-species/lost-fungi/.

Snow in Glenlyon on the way to the Lost Fungi Workshop (SJM McMullan-Fisher CC-BY-SA).

This group have succeeded in getting as much Victorian historical data into the project by November 1 as they could. We are now working to upload this data into the Victorian Biodiversity Atlas. This is the biodiversity tool used to assess the presence or absence of threatened species for developments, planned burns and the like.
We hope the increased number of verified fungi records will help land managers, parks, forestry and natural resources staff to consider their fungi.

Last but not least, we would like to give thanks to Dr Teresa Lebel from the Royal Botanic Gardens Victoria who gave the final presentation to the Bendigo Field Naturalists Club on August 15. She and two of the local fungi enthusiasts Joy Clusker and Di Davies got out to look for truffles and lost fungi the day after this talk.

Although the lost fungi list is currently focused on fungi that occur in Victoria, this list could be expanded and we hope that it will in the future. To facilitate this we have now made the Biocollect project national in scope.

Dr Teresa Lebel and Joy Clusker looking for for truffles and Lost Fungi near Bendigo (Di Davies)

Regional News

A Fun Fungi App - Central North Victoria

Gayle Osborne

The Wombat State Forest in Central Victoria is a fungi 'hot spot' with in excess of 400 species. Not only do an amazing array of fungi emerge each autumn, but two rare macrofungi Auriscalpium sp. 'Blackwood' and Sarcodon sp. 'Wombat' have only been found in this forest.

Fungi come in a fabulous array of shapes, sizes and colours that are sometimes enticing, sometimes disconcerting. They enliven our walks in autumn and winter.

According to Fungimap: "Despite their importance, little is known about what Australian fungi exist or about their distribution, conservation status, or the complex interactions they may have with flora and fauna."

We can help with mapping their distribution.

Wombat Forestcare members and other locals registered for the iNaturalist app last year and started uploading their sightings to the Fungimap Australia project. This was a lot of fun and the app is designed to make logging fungi sightings easy, although a reasonable knowledge of fungi species does help. See https://www.inaturalist.org/projects/fungimap-australia.

Russula lenkunya taken with an iPhone and submitted to iNaturalist (Gayle Osborne).

We headed in to the Wombat Forest armed with our phones (GPS engaged) and small enlarging mirrors to assist with the view from below. We photographed fungi from above and below as well as taking a photo of the surrounding vegetation.

On returning to a location with Wi-Fi we uploaded the images and attempted to identify them. iNaturalist has an image recognition algorithm that helps with suggestions of what you saw. For common fungi and good images it is often correct to species. However, when we were uncertain, we attempted to identify to genus level e.g. Mycena, Russula, Cortinarius etc.

While there are many resources to help – field guides and of course, the internet – we were advised to start with a few species that are easily recognisable.

We couldn't even try to identify everything we saw as fungi change as they mature, so the photo in a field guide may not match our images. Also there are a very large number of fungi that are not yet named.

There is a great desire in our community to learn more about the fungi of the Wombat Forest and this app helps us hone our observational skills and increase our ability to identify species.

We are now looking forward to another fungi season and hope to encourage more participants

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Fabulous Fungi- whole school cross-curricular program

Christine Cook, Walpole Primary School Principal

Walpole Primary School students are fascinated with fungi. So much so that the whole spent a term finding out more. Local businesses and community members were invited to participate in the journey and share their knowledge and skills with the students.

Walpole Primary School is located in the Walpole Wilderness, on the south coast of Western Australia. The town is surrounded by farms, waterways and national parks. This provides an ideal location to link education and environment. Every year, the school participates in their UR Walpole program that explores global issues within a local context. Past topics include The Billion Year Journey of the World and Great Migrations. The theme for 2019 was Fabulous Fungi.

Teachers, with local scientists, brainstormed various natural, cultural and futuristic issues involving fungi and built a program that encapsulates the topic and links it to the West Australian curriculum. Instead of having gills like typical mushrooms, most fungi in the family Bankeraceae

Students from kindy to year six will learn about the diversity
Students of Walpole Primary School discover the
fabulous world of fungi (Christine Cook).

and adaptations of fungi and the impact they have on all aspects of our lives. They wrote a field guide of local fungi and set up interpretive displays, on a tourist walk, using QR codes. Students grew mushrooms, baked bread and visited a truffle farm. They used microscopes to closely observe fungi, then draw the details. Their art work was framed and parents invited to an art exhibition at the local gallery.

Tropical Fungi Project

Fran Guard

In March 2018, a small group of amateur and professional mycologists carried out a project on Australian Tropical Fungi, with support from the Queensland Mycological Society (QMS), the Queensland Government through an Advance Queensland Engaging Science Grant, Bush Heritage Australia (BHA), plus Landcare and Environment Groups from north Queensland.

The community engagement of the project was a complete success, with very positive reviews from approximately 160 participants. It included several introductory workshops for community members, a public meeting and a masterclass on polypores. The team also undertook three days of fungal

Marasmius pellucidus (Fran Guard CC-BY-SA).

surveys on Brooklyn Reserve, owned by the Australian Wildlife Conservancy, with other forays conducted in the Cairns, Kuranda, Malanda and Davies Creek areas. The 260 specimens collected have been worked on through the year by Sapphire McMullan-Fisher, Matthew Barrett, Frances Guard and Teresa Lebel. Use of DNA barcoding has helped sort some of the more obscure genera and species. Exciting new finds will be published in due course.

Fran Guard and Sapphire McMullan-Fisher on a tropical foray.
(Fran Guard CC-BY-SA).

Part of the work of this project was to gather data for the production of a tropical fungi field guide. Currently there is enough material with vouchered specimens to produce a pocket guide. There is considerable demand for such a resource across the Wet Tropics.

So we are now working on Part Two of the Tropical Fungi Project, applying (and hoping) for another government grant, assured of support from QMS, BHA and north Queensland Groups. In March of 2019, we launched the first our Pocket Guides 'Australian Tropical Mushrooms & other Fungi' (available from the Fungimap shop).

For more information please contact Frances Guard, Project Manager, at franguard[at]icloud.com.

Native Australian hedgehogs: the description of new *Sarcodon* species

James Douch, University of Melbourne School of BioSciences

Instead of having gills like typical mushrooms, most fungi in the family Bankeraceae have spore-bearing spines and are thus called 'hedgehog' Instead of having gills like typical mushrooms, most fungi in the family Bankeraceae have spore-bearing spines and are thus called 'hedgehog' or 'tooth' fungi. Members of this family with the hedgehog-type morphology are in the genera *Bankera, Hydnellum, Phellodon*, and *Sarcodon*. The other two genera, *Boletopsis* and *Corneroporus*, have pores instead of gills or spines. The family is characterised by a fenugreek smell and irregularly ornamented spores. *Corneroporus* can be distinguished from *Boletopsis* by its spiny, rather than tuberculate spores. *Bankera* and *Phellodon* share the common characteristics of a white spore print and echinulate spores, but the former genus can be distinguished from the latter by its lack of pileus colour zonation and its relatively fleshy fruit-body. *Hydnellum* and *Sarcodon* both feature tuberculate spores and most species yield brown spore prints, but only *Sarcodon* species may feature a cracked pileus.

A *Sarcodon* specimen found in Victoria by John Walker. Photographs are taken by John Walker and used with permission.

Observations and collections of *Sarcodon* in Australia are remarkably few. The only other Bankeraceae to be recorded in Australia are the more frequently observed *Hydnellum* and *Phellodon*. Marked population declines of some species in the Bankeraceae in Europe, apparently due to soil nitrification, have resulted in several species being listed on national red lists and several being listed on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species. One *Boletopsis* species from New Zealand, *B. nothofagi*, is listed as Endangered by the IUCN. These declines are likely to have broad ecological implications given the important role these fungi play in symbiotic nutrient exchange with various trees, including *Eucalyptus* and *Nothofagus*.

Australian *Sarcodon* species may also be in need of conservation, but this cannot be determined or effectively acted upon until the taxonomy is well resolved. However, taxonomic studies of *Sarcodon* have concentrated on European and American representatives. In fact, concerningly, not a single *Sarcodon* species has been described from Australia.

To resolve this, I produced phylogenetic trees with ITS, LSU, and tef1 DNA sequences I generated from herbarium collections, mostly from the National Herbarium of Victoria, but also from the Western Australian Herbarium and New Zealand Fungarium. I also incorporated DNA sequences from the Australian Microbiome Initiative (AMI), isolated from soil samples around Australia. These analyses were supported by observations of morphological variation between collections, particularly regarding hymenium decurrency (ranging from adnate to decurrent), pairing of spore tubercles (ranging from paired to unpaired), size of spore tubercles (ranging from prominent to almost absent), and the presence or absence of clamp connections.

The outcome of these studies is the description of four new *Sarcodon* species that will be formally described in a forthcoming publication. This outcome is critical, as it allows for the potential conservation needs of these species to be determined as further data accumulates. Several other possible species were detected from single collections but will remain as informal, putative species pending additional collections. My analysis of the AMI data also revealed for the first time that *Bankera* and *Boletopsis* occur in Australia. Each of these genera appear to be represented by a single undescribed species. The *Boletopsis* DNA was detected in soil samples to the west of the Blue Mountains National Park, NSW, and from Arve Loop Forest Reserve, Tasmania. The *Bankera* DNA was detected in soil samples from Solus, WA, Yellabinna, SA, and the Blue Mountains National Park, NSW. Targeted searching for fruit-bodies in these locations is needed to produce collections that can facilitate the formal descriptions of these species. The discovery of new genera in Australia using AMI demonstrates the power of metabarcoding as a tool for studies of biodiversity, and the ongoing discovery of conspicuous, macroscopic species highlights that the diversity of fungi in Australia still remains largely unknown.

This study was conducted as a Bachelor of Science (Honours) research project in the University of Melbourne School of BioSciences, supervised by Dr Alexander Idnurm and Dr Tom May.

Identifying Fungi in Scotland

Robin Garnett (First published in the The Natural News of the Central North Field Naturalists Club of Tasmania)

How willing would you be to taste the "milk" that exudes from broken *Lactarius* gills?

This was indeed what our fellow fungi foragers did on a course that Phil Collier and I attended at Kindrogan Field Studies Centre near Pitlochry in central Scotland. We were surprised by how much tasting and smelling goes on when fungi enthusiasts identify British fungi. Chris Knowles, our tutor, smelled every fruiting body he collected: "Does it smell of fish? ... or coconut? ... or paint? ... or carbolic soap?" He used his tongue to test the viscosity of the cap and nibbled a tiny piece of each gill before wiping his mouth on a tissue.

Gomphidius glutinosus Robin Garnett (CC-BY-SA).

Our eleven fellow course participants were all keen, knowledgeable amateurs; some were here for the fourth year running. Several worked for the National Trust of Scotland, one flew in from the Singapore Botanical Gardens, whilst others, like us, were just interested in extending their mycological skills. We noticed that people in our group took particular note of the tree or shrub species near each fungus. They would often put a few leaves from nearby trees in their collecting pots to help with identification later on. For example, there is a beech bolete, a chestnut bolete, a pine bolete and an oak bolete.

Scotland was looking particularly beautiful in mid-October, with its fast-flowing rocky rivers and woods turning yellow, orange and red. We went to places we know from songs and stories: by Tummel, and Loch Rannoch, Aberfeldy and Killiecrankie. Each morning we set out with our baskets full of pots and brought back our trophies to the lab to identify in the afternoons and evenings.

If we came across an unusual species, too precious to pick, Chris would photograph it, then spread a piece of aluminium foil across its gills and wrap the edges over the cap to hold the foil in place. He would cover the fruiting body with a pot, weighing it down with a stone on top. An hour or so later, he would collect the foil and take it home to examine the spores without disturbing the fungus.

Back in the lab we would set up our spore prints. If fruiting bodies were a bit dry, we would try to coax the spores out by supporting the cap over two glass slides, with the stipe hanging down over a beaker of water. The water helped maintain humidity around the fruiting body and aided the hydroscopic expulsion of spores. We then pulled out the reference books and microscopes, razor blades and stains to do the detective work needed to try to identify each species we had collected.

Phil and I were amazed to hear that there are over 12,000 species of fungi in Britain. There are also some excellent keys and monographs to help with the identification process. As in Australia, there are some spectacularly coloured fungi and many, many small brown ones. And lots of them have common names, sometimes quite evocative common names: Plums and Custard, Elfin Saddle, Toad's Ear, Destroying Angel.

Tolypocladium capitatum Robin Garnett (CC-BY-SA).

It was fascinating to see some of the fungi that are parasitic on other fungi. Tiny pale Silky Piggyback, *Asterophora parasitica*, were growing in the decomposing, blackened remains of large *Russula nigricans*, and the Cordyceps-like Drumstick Truffleclub, *Tolypocladium capitatum* were growing on the underground false truffle, *Elaphomyces granulatus*. We found people, on the whole, shied away from keying out *Inocybes, Entolomas, Cortinarius* and *Hebelomas* to species level as these have a reputation for being difficult.

We rashly said we would have a go at identifying *Hebelomas*, little realising that the 35 British species have very subtle microscopic differences, all described in a recent 1200-page monograph. Everyone brought us their *Hebelomas* after that. First we needed to smell them: could we detect a sweet smell, radish or marzipan? And were watery droplets emerging from the gills? Next we tested the spores with Melzer's reagent to see whether there was a dextrinoid reaction that turned the spores reddish brown. After that we had to look at the size and shape of the spores. Then we looked at the cheilocystidia which grow only at the bottom edge of the gills: were they like skittles or worms? And were the caulocystidia on all or just part of the stipe? I won't go on with more details but suffice to say that we came to understand why people in our local Hampshire Fungi Group avoid identifying *Hebelomas* if they can.

At the end of each day we all took our identified fungal specimens with their name tags to a display room, where we arranged them by genera. By the end of the week, as well as some wriggling maggots, there was a magnificent collection, from enormous boletes and *Lactarius* to minute *Galerina* and *Mycena*.

The course was inspiring and educational. We recommend it to anyone fortunate enough to be able to spend a week in Scotland in October.

Records

'Photos' are the number retained by Fungimap as verifications of records.

Australia (by email)

	Records	Photos
David Akers	1	2
Gail Badke	1	1
Roger Barker	1	2
Oscar Bassi	1	1
Patrice Baxter	18	26
Emily Bell	2	2
Nigel Beresford	1	1
Victoria Bodell-Brown	1	1
Jordan Bonner	1	1
Mark Bouck	1	1
Crispin Boxhall	1	2
Andrew Browne	1	1
Daniel Burton	1	1
Max Campbell	1	3
Chris Cook	1	1
Herman Cramer	1	2
Valeria De la pina Raez	1	1
Alan Dicker	1	1
James Douch	1	1
Noel Dyster	1	1
Maya Eats	1	2
Mark Egan	1	1
Jess Faustini	1	1
Velta Fellowes	1	1
Erika Ford	1	1
Annabel Forrest	1	1
Moiya Fraser	1	1
Sujaree Gibson	1	1
Bridgette Gower and Toby Dean	1	1
Dr Brian Graetz	1	2
Darryl Griffiths	1	1
Tiffany Harding	1	2
Rem Hayes	1	2
Cheryl Herbert	1	2
Diann Hopkins	1	1
Joanne Isaac	1	1
Susan Jackson	1	3
Vicki Jaeger	2	3
Kyle James	1	1
Anthony Jones	1	1
Mathew Kay	1	2
Ray Kazlauskas	1	1
Fabian Kmet	11	16
Peter Koch	2	5
Meredith Kraina	1	1
Lucy Larkins	1	2
Kathy Leddy	1	1
Eilif Liland	1	2
Jess Logan-Warner	2	1
Nicole Lucas	1	1
Judy Maddams	1	1
Lynda Male	1	6
Luise Manning	1	1
Sarah Maxwell	1	2
Aaron McArdle	2	2
Brett Mifsud	8	9
Sue Morgan	1	1
Peter Muller	1	2
Leonie Mynott	1	2
Peter Newling	1	2
Benedict Noel	1	1
Ben P	2	2
Gordon Patrick	1	2

	Records	Photos
Jamie Pronk	1	1
Dave Puckering	1	2
Chris Reichl	1	1
Vivien Rk	1	1
Belinda Rossack	1	1
Karen Sell	2	2
Elizabeth Sheedy	58	2
Tim (Tian Shi)	1	2
Warren Simmons	1	1
Mark Slater	1	1
Darren Smallwood	5	10
Charles Snape	1	1
Bob Stocker	1	2
Christophe Tourenq	1	1
Chris Van Cooten	1	1
Janet von Berky	9	13
Damien Whitely	1	1
John Widdup	1	1
Tania Wilby	1	2
Chris Wilson	1	2
Clint Wilson	2	1
Jeremy Wood	1	1
Thea Yates	1	0
Ngawang Yeshe	1	1

NSW

Paula Breese	1	1
Elisabeth Burton	1	2
Martin and Frances Butterfield	15	11
Aida Che Man	1	1
Norm Clarke	5	11
Fiona Duggan	10	14
Ian Faulks	1	1
Judy Harvey	1	2
Myrna Koudsy	1	2
Jane Lynch	2	4
David Muscatello	1	1
Greg Ogle	1	1
Kristina Rajkovic	4	4

QLD

Roslyn Blackband	1	3
Diane Garvie	13	18
Vern Hansen	75	129
Rod Hobson	2	0
Jill Yeoman	1	1

SA

	Records	Photos
Adelaide Fungal Studies Group	231	
Pamela Catcheside 0	81	

VIC

	Records	Photos
Ronnie (Unknown)	1	1
Karen Brisbane	2	3
Kirsten Cameron	1	1
Wendy Cook	177	0
Jenny Devonshire	1	2
John Eichler	16	9
Cecily Falkingham	73	6
Field Naturalists Club of Victoria	354	0
Karen Garth	2	4
Geelong Field Nats Club Inc.	2	0
Sally Green	25	16
Richard Hartland	70	78
Joy Hick	4	4
Eileen Laidlaw	54	77
Jean Lightfoot	49	0
David Lipshut	2	2
Adrienne Lyons	1	1
Ivan Margitta	145	2
Malcolm McKinty	50	57
Sapphire McMullan-Fisher	3	0
John Miller	1	3
Dianne Nicholson	1	2
Graham Patterson	14	0
Lorraine Phelan	3	3
Nick Pietsch	1	1
Win Pietsch	45	0
Amy Quinn	4	4
Rosalind Smallwood	1	2
George (Unknown)	1	2
Helen Van Riet	1	1

WA

Kerryann Hall	1	1
Wayne Jackson	2	4

STOP PRESS: Australian fungi included on IUCN Red List of Threatened Species

Tom May, Royal Botanic Gardens Victoria

Earlier this month, 51 species of fungi were formally added to the IUCN Red List of Threatened Species, as a result of assessments carried out at the Australasian Fungi Red List Workshop held in Melbourne in July.

This is a significant increase in the number of species assessed for the region taking the total species in the Red List that occur in Oceania to 71

You can see information on each species on the IUCN Red List website https://www.iucnredlist.org/search

Using the advanced search option, you can choose Taxonomy =Fungi and Land regions =Oceania, to show the list of all species that occur in the region that have been assessed to date.

Note that some fungi additional to those assessed in the Workshop are also included. These are mostly widespread fungi with Least Concern assessments such as Agaricus campestris (that have been assessed over their whole range) and a few species of lichenised fungi and three non-lichenised fungi added several years ago (Claustula fischeri, Boletopsis nothofagi and Lactarius novae-zelandiae, the first from Australia and New Zealand, and the other two from New Zealand).

As well as viewing assessments on line, you can download each assessment as a pdf (with a doi - so they are citable documents).

In the assessment of each species there is documentation of geographic range, habitat & ecology, population trends and threats, and an overall justification of the assessed category. Categories included Critically Endangered, Endangered, Vulnerable, Near Threatened and Least Concern, and some species have been assessed as Data Deficient. The criteria met in order to match a particular threat category are also provided: these are the letters and numbers after the category. For example, Hygrocybe boothii is assessed as Endangered under categories B1ab(iii,v) and D.

The three **Critically Endangered** species in Oceania are:

Podoserpula miranda from New Caledonia, *Hypocreopsis ameplectens* from Australia and New Zealand and *Deconica baylisiana* from New Zealand.

In total for the region, there are now 3 fungi listed as Critically Endangered, 15 as Endangered and 9 as Vulnerable. Species that occur in Australia that are listed as Critically Endangered (CR), Endangered (E) or Vulnerable (V) are:

CR - *Hypocreopsis ameplectens*

EN - *Auriscalpium* sp. "Blackwood", *Entoloma ravinense*, *Heimioporus australis* and *Hygrocybe boothii*

VU - *Amanita elongatospora, Antrelloides atroceracea, Austroboletus viscidoviridis, Bondarzewia retipora, Cyttaria septentrionalis, Macrolepiota eucharis* and *Sarcodon* sp. "Wombat"

Data from the Fungimap record database was often used in the course of making the assessments. The first step for each assessment was to work out where the species occurs, and what are the habitat requirements. In time, Fungimap data will also be able to be used to track declines or improvements in populations of endangered fungi. In particular, the Lost Fungi project (https://fungimap.org.au/cva-project/) is already collecting rich data on individual endangered species, including H*ypocreopsis amplectens*.

As a follow up from the listing, some suggested next steps are:

(1) Any species formally assessed at a global level at a given threat category is highly likely to be at least as threatened at a national or regional (state) level. Therefore, it would be ideal to present species for nomination under relevant legislation in your particular region, if not already listed.

(2) Make sure local conservation agencies and land managers are aware of all the red-listed species, so that they can be included in management plans.

(3) Some species have been listed under temporary "tag" names - these should be shortlisted for taxonomic effort to create formal descriptions.

Looking ahead - in 2020 the Australasian Mycological Society will be holding its Scientific Meeting in Hobart in July (10-11). The AMS Fungi Conservation Group will be organising another Red List Workshop before or after the 2020 AMS meeting in Hobart.

Acknowledgements

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Donations

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Sponsor a species

We are delighted that species have been sponsored by: Kaye Proudley, Frances La Fontaine, Tiffany Harding, Matthew Smith, Ed Grey, Elizabeth Fenton, Tim Cannon, the WA Naturalists Club, Roy Halling, Katrina Syme, Sapphire McMullan-Fisher, Justin Byrne, Robert Bender, Ronda Warhurst, Robin Harding, Karen Waldon-Manning, Steve Young, Eileen Laidlaw, Mark Learmonth and Elizabeth Sheedy.

If you would like to sponsor a species please check https://fungimap.org.au/get-involved/sponsor-a-species/. We recognise the great efforts of our volunteer team producing the second edition of Fungi Down Under, coordinated by Pam Catcheside and Tom May, with considerable assistance with InDesign from Sarah Lloyd during 2018-2019.

Project partners

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Volunteers

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This newsletter was compiled and edited by Cameron Dunsford with assistance from Wendy Cook, Sapphire McMullan-Fisher and Tom May.

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