

LINNEAN SOCIETY OF NEW SOUTH WALES

LINN S'O'C' NEWS

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INCLUDED WITH THIS ISSUE

Form for tax-deductible donations
 Record of the 2017 AGM

NEW MEMBERS: We welcome our new members:

Mr. Brian J. Atwell, Macquarie University. Field of interest: Plant ecology.

Mrs. Victoria Austin, Western Sydney University. Fields of interest: Animal behavior, bird vocalisation

Miss Belinda Fabian, Macquarie University. Fields of interest: Microbiology, molecular biology, plant physiology, plant disease/pathology.

Mr. William Firth-Smith. Field of interest: Zoology.

Miss Casey M Gibson, University of NSW. Fields of interest: plant ecology, evolutionary ecology.

Ms Melinda J. Greenfield, James Cook University. Fields of interest: Interactions between fungi, plants

and insects.

Ms Anna J. Kretzschmar, University of Technology. Fields of interest: Molecular biology, bioinformatics, toxin evolution, climate change, *Gambierdiscus* spp, ciguatera fish poisoning.

A/Prof Shauna Murray, University of Technology. Fields of interest: Evolution, marine biology, genetics, phylogenetics.

Mr. Aaron Phillips, Macquarie University. Fields of interest: Plant molecular biology, plant physiology. .

Ms. Bronwyn Teece Macquarie University. Fields of interest: palaeontology, geology, organic geochemistry, astrobiology.

DONATIONS TO THE SCIENTIFIC RESEARCH FUNDS

Donations received last year but no previously acknowledged were made by M. Ian Hills, Dr. Lawrence Sherwin, the Sisters of Saint Joseph and Ms Claire Sives. We thank our generous donors: the donations are much appreciated.

PROCEEDINGS OF THE LINNEAN SOCIETY OF NSW, VOLUME 138 (2016)

The *Proceedings* is published on line and may be accessed free of charge by anyone at the website <http://ojs-prod.library.usyd.edu.au/index.php/LIN>

Lunney, D, Wells, A and Miller, I. An Ecological History of the Koala *Phascolarctos cinereus* in Coffs Harbour and its Environs, on the Mid-north Coast of New South Wales, c1861-2000

King, R.J. Julian Tenison Woods: Natural Historian

Fulton, G.R. New Information about the Holotype, in the Macleay Museum, of the Allied Rock-wallaby *Petrogale assimilis* Ramsay, 1877 (Marsupialia, Macropodidae)

Fulton, G.R. Bramble Cay *Melomys Melomys rubicola* Thomas 1924: Specimens in the Macleay Museum

Timms, B.V. A Study on the Pools of a Granitic Mountain Top at Moonbi, New South Wales

Mo, M. The Beach Stone-Curlew (*Esacus magnisrostris*) in the Sydney Basin and South East Corner Bioregions of New South Wales.

MARCH FOR SCIENCE

The March for Science celebrates the public discovery, distribution, and understanding of scientific knowledge as crucial to the freedom, success, health, and safety of life on this planet. It is nonpartisan and the march is to demand action in the areas of Literacy, Communication, Policy, and Investment. This is part of a world-wide program of similar events and will be held on 22 April. The Linnean Society of NSW supports the principles upon which the March for Science is based and urges all to attend. For further information, see the website <https://marchforscienceaustralia.org>

AWARDS FROM THE SCIENTIFIC RESEARCH FUNDS

The amount awarded to applicants is in part dependent on the funds available. If there are more requests for funds than money available, the Society must make the difficult decision to reduce the amount awarded or not to fund otherwise worthwhile projects. The current low interest rates limit funds available and will make these decision more difficult in the future.

Julian E. Tenison Woods Award (provided by the Sisters of St Joseph to the Linnean Society of NSW).

Dr Sanja **Van Huet**, Deakin University.

Project: Drone Mapping of the Bridgewater Formation, Nepean Peninsula, Victoria

Synopsis: The project aims to compile a detailed photographic record of the extent of the Bridgewater Formation from Barwon Heads to Cape Schanck in Victoria, using a remote controlled drone. This footage will be used to produce detailed 3D mesh reconstructions of the Bridgewater coastline – including otherwise inaccessible areas. These reconstructions will enable detailed regional mapping of the Bridgewater Formation. Awarded **\$1,250** for extra drone batteries, recharging generator & insurance.

Julian E. Tenison Woods/ Joyce W. Vickery Scientific Research Award

Ms Melinda J **Greenfield**, James Cook University

Project: Interactions among fungi, ants and the ant-plant *Myrmecodia beccarii* (Rubiaceae).

Synopsis: *Myrmecodia beccarii* (Rubiaceae) is an epiphytic ant-plant endemic to far north Queensland in coastal *Melaleuca* forests and mangroves, north of Townsville. The domatia of *M. beccarii* is a tuber-like structure that contains a network of tunnels and chambers commonly occupied by the native ant *Pholidris cordata*. There are several types of tunnels, including light brown and dark brown/black tunnels, each with different functions. Two taxa of fungi were discovered in the domatia chambers but their identity and function(s) are unknown. Elsewhere in the world, some ants farm fungi in the domatia. This project will identify the fungus and investigate the interactions among fungi, ants and *M. beccarii* to establish if there is a tripartite mutualism. *M. beccarii* is listed as vulnerable, mainly due to habitat fragmentation. It is habitat for the larval stages of the Apollo Jewel Butterfly also vulnerable, which feeds exclusively on this plant and has a mutualistic relationship with the native ant *Phi. cordata*. Attempts to translocate *M. beccarii* in revegetation projects tend to fail because little is known about their requirements for successful establishment and growth. This project may provide a better understanding of the complex interactions within this ant-plant that could assist in conservation. Awarded **\$2,300** for experimental consumables.

William Macleay Award for Microbiology Research

Miss Belinda **Fabian**, Macquarie University

Project: Genetic factors influencing colonisation by biocontrol bacteria of plant surfaces.

Synopsis: *Pseudomonas* bacteria are some of the most successful biocontrol bacteria and one of the most well-known strains, *Pseudomonas protogens* Pf-5, has the ability to control diseases that affect cotton, wheat, pea, maize, tomatoes and potatoes, hence could be a valuable alternative to the use of pesticides on crops. However, field trials of biocontrol bacteria show a lack of reliability and persistence on plant surfaces. A number of genes involved in plant surface colonization have been identified, but not any genome-wide study of essential colonization genes. This project will investigate ways to make colonisation more reliable. Awarded **\$1,300** for sequencing materials

Ms Anna L **Kretzschmar**, University of Technology Sydney

Project: Evolutionary relationship of *Gambierdiscus* species and ciguatoxins.

Synopsis: Some species of the marine protist genus *Gambierdiscus* produce the polyketide neurotoxic ciguatoxins, which enter the food chain and accumulate to ultimately cause ciguatera fish poisoning. Ciguatera is prevalent in the Great Barrier Reef region and since 2014, outbreaks of ciguatera have occurred in New South Wales, and this has been linked to the change of the East Australian Current due to climate change. Currently, the pathway of the production of the toxins is not known, although it is known that the enzyme(s) involved are of the polyketide synthase (PKS) class. This project will look at the evolution of the entire enzyme class, the evolutionary relationships of the order Gonyaulacales and *Gambierdiscus* within the order, map the active domain(s) of the PKS enzyme class over the species tree and match the polyketide toxin production of the extant species. This would allow us to track the evolution of copies of individual domains and match them with the polyketide toxin producing status of the species. Awarded **\$1,300** to attend a special workshop (USA) to gain necessary specialized skills.

Betty Mayne Award for Scientific Research in the Earth Sciences

Iain **Copp**, University of Western Australia

Project: Geodiversity–biodiversity relationships in the southern Southwest Australian Floristic Region

Synopsis: The primary aim is to quantify the relative influences that different geological substrates and their landscape position have on the distribution of vegetation types, species diversity and endemism, and how geodiversity correlates with vegetation patterns. Three hypotheses will be tested within a global biodiversity hotspot — the Southwestern Australian Floristic Region (SWAFR): vegetation types, species diversity and endemism are positively correlated with major regolith–landform types; sandplain sedimentological–mineralogical heterogeneity is positively correlated with diversity and distribution of kwongan heath communities; and the near-subsurface architecture and hydrology of granite-inselberg landscapes influences surrounding vegetation distribution and species diversity. Awarded **\$750** for field work expenses.

Sarah **Houlahan**, Macquarie University.

Project: The Role of Archaeocyathid Reef Bioconstruction in Early Animal Evolution

Synopsis: The project will investigate and document the ecomorphological variation, architectural growth styles, biofacies distribution and biogeochemistry of stromatolites during a period that coincides with Cambrian radiation of animal life. Awarded **\$1,000** towards analytical costs.

Bronwyn **Teece**, Macquarie University.

Project: Stromatolite construction, biofacies and biomarkers in Lower Cambrian carbonates of the Hawker Group, Arrowie Basin, South Australia

Synopsis: This project aims to reveal the function and impact of reef building ecosystem engineers as the key driver in diversification and escalation of ecological complexity during the Cambrian radiation. Lower Cambrian reefs are built primarily by archaeocyathids, which act as bioconstructors, and calcimicrobes, which cement the biohermal structures. Awarded **\$1,000** towards analytical costs.

Dr Tony **Wright**, University of Wollongong

Project: Silurian and Devonian rugose corals from New South Wales

Synopsis: The project involves a systematic revision of Early Devonian rugose corals from NSW that have been assigned to *Phillipsastrea*, including a dozen described species and about half a dozen undescribed species, mostly from the Mudgee area. This substantial project commenced a couple of years ago and is expected to run into 2018. A concurrent project involves description of new genera from Limekilns and Panuara (near Orange). Awarded **\$818** to defray fieldwork expenses.

John Noble award for Invertebrate Research

Miss Cara **Van der Wal**, Sydney University

Project: Assessing the conservation status and genetic diversity of two endemic crayfish *Euastacus spinifer* and *Euastacus australasiensis* using molecular approaches.

Synopsis: Freshwater crayfish are extremely diverse and the Australian groups are the most endangered of all extant species. Fresh water crayfish are important as ecosystem engineers, keystone species and bioindicators. There are about 50 species in the genus *Euastacus* that is found from northern Queensland to southern-most Australia. *E. spinifer* and *E. australasiensis* are cold adapted, both are morphologically variable and species determination can be difficult. They occur over a long range of distribution, but research with other species of *Euastacus* has indicated that there is very little gene flow/dispersal between habitats within the same stream. Molecular techniques will be used to investigate if there are several species involved. Awarded **\$1,500** for DNA analysis

Joyce W. Vickery Scientific Research Awards

Mrs Victoria **Austin**, Western Sydney University

Project: The functions of vocal mimicry in female superb lyrebirds (*Menuna novaehollandiae*).

Synopsis: Until recently, it was thought that only males exhibited bird song in the breeding season while song in females was rare. It has now been discovered that song is widespread and ancestral in females.

Songbirds evolved in Australia but little is known about the evolution of vocalization in both females and males. Many of the ancient songbird families are still extant providing excellent research opportunities. As well having vocal females, many of these ancient Australian songbirds are excellent mimics. Females use complex and diverse vocalisations for female-specific contexts (such as nest defense). When feeding, females mimic predators. Early indications suggest that sounds mimicked by females are consistently different to males and quite variable amongst females. This project aims to investigate the function of mimetic vocalization and will be conducted in the wild. Awarded **\$2,334** for a Song Meter, microphone and cables.

Miss Hannah **Bannister**, University of Adelaide

Project: Diet of the brush-tail possum in Ikara-Flinders Ranges National Park prior to European settlement.

Synopsis: The brush-tailed possum population once covered most of Australia but is much reduced today, particularly in arid regions. It disappeared from this national park about 70 years ago, but has been reintroduced. It is likely that the diet of the reintroduced possums is different from their pre-European diet because they now have competition from introduced herbivores. There are many rocky slopes in the Flinders Ranges where caves are present and brush-tailed possums have been found there. The possums are likely to be hundreds of years old. A pilot study to see if diet-species can be identified with Next Generation Sequencing of the possums is under way. Then the present diet of brush-tailed possums can be compared with pre-European diets. Awarded **\$1,500** for next generation sequencing of possum possums.

Miss Nasim Shah **Mohammadi**, University of Technology Sydney.

Project: Identification of new high resolution genetic markers for the endangered Australian seagrass, *Posidonia australis*.

Synopsis: *P. australis* is categorized as threatened, and in some locations, endangered. It forms extensive populations in harbours where it may be subjected to disturbance, and restoration and conservation management is necessary. Molecular biology will provide an insight into genetic diversity and resilience in the populations. Whole transcriptome sequencing gives high-resolution genetic markers and can be used to detect simple genetic repeats that allows detection of polymorphisms. The genetic sequence will be available to others for further study. Awarded **\$1,000** for car hire and RNA extraction and sequencing.

Mr Aaron **Phillips**, Macquarie University.

Project: Searching for the basis of heat tolerance in Australia's arid-zone plants.

Synopsis: Under climate change, temperatures are increasing and the intensity and duration of heat waves are also increasing. Heat stress is a major limiting factor on photosynthesis that in turn limits yields in crop plants. Understanding how plants adapted to hot environments could assist improved crop productivity. Rubisco activase (RCA) is a photosynthesis related protein found in all plant species. RCA increases a plant's ability to fix CO₂, but its activity is diminished by supra-optimal temperatures. Substantial variation exists in the gene sequence coding for RCA and heat acts as a selective force generating similar mutations. The forms of RCA that evolved at higher temperatures are now of world wide interest. To date, only about six species have been investigated with the most persuasive evidence coming from relatives of rice in northern Australia. This project will investigate the efficiency of RCA isoforms from a range of Australian indigenous relatives of rice, cotton and tobacco that are adapted to temperature regimes from cool temperate to the hot arid zone, and the response of photosynthesis under heat stress. Awarded **\$2,500** for analysis of the abundance of RCA in leaf tissue.

Claudia **Santori**, University of Sydney

Project: Halting the decline of the Murray River turtles: threat assessment and alternative conservation approaches.

Synopsis: There are three species of turtles in the Murray-Darling Basin and because of their large biomass, they are a key component of the ecosystem, recycling nutrients through their broad diet. The carrion consumption by the turtles is fundamental in preventing eutrophication and turbidity. Disappearance of the turtles could be problematic for the river system. There has been a drastic decline in the turtle population (especially the juveniles), mainly due to predation of the turtle nests by foxes. Other hazards to turtles are dams and weirs, collisions with boats, drowning by pumps and carp screens and road kill as they move overland to their breeding sites. This project will assess the risk factors and rank them, and this will assist conservation management. Awarded **\$900** for car hire and petrol.

Miss Sonu **Yadav**, Macquarie University

Project: Understanding the adaptive capacity of alpine grasshoppers under climate change.

Synopsis: Mountain ecosystems are highly sensitive to climate change and human modification of the landscape. The persistence of many insect species is under threat from rapid climatic change and their survival largely depends on their adaptive capacity and underlining genetic processes. *Kosciuscola cognatus* and *Kosciuscola tristis* will be collected from three sites within Kosciuszko National Park and 98 samples will be sequenced to evaluate the genetic diversity, gene flow and genetic admixture in these species. The project will predict changes in distribution and the likelihood of hybridization in the grasshoppers with changing climate. Awarded \$900 for genomic sequencing

TRANSFORMING DIETS AND LIVES IN THE HIGHLANDS OF PAPUA NEW GUINEA THROUGH FISH FARMING, a talk given by A/Prof Jes Sammut

More than 80% of the people in Papua New Guinea are rural-based and depend on subsistence agriculture, and most people live on less than \$1.50 a day. The people grow vegetable crops but small-scale chicken and pig farming cannot sustain the protein requirements of the population. Hunting cannot meet the needs for protein either. There is a lack of infrastructure with no electricity for many and a lack of a road network. Most people live in primitive conditions. Canned meats and tuna are too expensive for many. Smoked dried fish is not good for them for too much can cause stomach cancer. There is a high consumption of salt, lamb flaps (mostly fat and of little nutritional value) and carbohydrates that have a high GI and are not good for health.

Malnutrition is the leading cause of death in children in PNG. 31% of the children are stunted and this is attributed to the lack of protein and a high vegetable/carbohydrate diet. 76% of children between 6-10 years consume less than 2/3 of the FAO/WHO recommended daily level of protein. They have pigs, but they are expensive and if killed, the meat cannot be stored without refrigeration. The pigs are only killed for big ceremonies. HIV and TB are prevalent and the poor response to treatment is linked to a low protein diet.

There is social control over access to protein: father eats first and most, then the other men eat, followed by the wife and then the daughters. Malnutrition is also a problem with wealthy people in PNG because of poor food choices. Fat people can be malnourished also, with poor health.

A/Prof Jes Sammut and associates have been training people in remote villages to farm fish for their own consumption and for profit. There was some fish farming, but the fish were not doing well from lack of food and inbreeding. The fish are carp related that thrive in a basic mud pond. Team members teach the farmers how to make fish food pellets to boost productivity, but the fish do quite well on the insects, algae and plankton in the pond without extra feeding. Fish provide protein at an affordable cost and can be caught and cooked when needed, without refrigeration.

The social changes that come with a better diet are remarkable. Clans that had been at war for decades now cooperate, sharing shovels, pumps, equipment and knowledge. Old adversaries become unexpected business partners. Sammut knows of three tribal wars that have stopped with the introduction of fish farming. With better nutrition, their health is better and there is less crime. With more income, the children can go to school and with better nutrition, they are able to concentrate on the schoolwork. Prisoners are being taught fish farming so that when they are released, they have something to support themselves. In an interview, one man who had committed murders said that when he felt like murdering someone now, he looks at his fish pond and realizes how much he has now, and does not feel like murdering any more.

This work in PNG is particularly important where even a small change makes a big difference. Seeing the impact that it has on the people's lives fuels Sammut's desire to keep going. The aim now is to find better fish stocks that are more self-sustaining.

LINNEAN SOCIETY OF NEW SOUTH WALES

For Security reasons, there is now a locked gate between the carpark and the Classroom. If it is locked when you come to a lecture, just wait and someone will come and let you in.

PROGRAMME

**Wednesday 19 April at 6 pm, in the Classroom, Royal Botanic Gardens
Enter through the gate to the Herbarium Carpark on Mrs. Macquaries Rd.**

KAREN WILSON

Honorary Research Associate, National Herbarium of NSW

**BIODIVERSITY OF MADAGASCAR, THE GREAT RED
ISLAND**

An overview will be given of the natural history of Madagascar, a continental island that is part of the old Gondwana landmass but isolated for at least 40 million years. Its fascinating mix of mainly endemic plants and animals has been strongly influenced by the varied topography and geology. As with other islands, there is relatively low diversity in families but great diversity at the species level. Iconic species include the lemurs, chameleons, geckoes, several endemic bird families, and the baobabs, poinciana, and traveller's palm. Humans arrived there only about two thousand years ago from the Indonesian region, with later migrations from African and Arabic regions. Their arrival seems to have coincided with numerous animal species going extinct, judging by the known fossils of giant and dwarf species. There have also been coincident changes in the vegetation.

**Wednesday 24 May at 6 pm, in the Classroom, Royal Botanic Gardens
Enter through the gate to the Herbarium Carpark on Mrs. Macquaries Rd.**

Dr DAN BICKEL

Australian Museum Research Institute

**"TEARS OF THE GODS" - THE HISTORY AND SCIENCE OF
AMBER**

Amber has fascinated people since prehistoric times and has long been traded from sources along the Baltic Sea. As well as being admired and used in jewellery, amber is of great scientific interest

as it provides a clear window to past life. Being the hardened and fossilized resin of ancient trees, amber frequently contains inclusions of trapped animals and plants, where tiny insects and delicate floral structures can be seen in exquisite detail. Amber therefore is a great source of information about both the evolution and distribution of major biotic groups and past environments generally. Within the last 20 years, significant amber deposits have been discovered in Australia. These include Cape York amber, washed up on remote beaches, and Cretaceous and Paleocene deposits from Victoria and Tasmania. This talk will review the history, occurrence and study of amber. .

**Wednesday 19 July at 6 pm, in the Classroom, Royal Botanic Gardens
Enter through the gate to the Herbarium Carpark on Mrs. Macquaries Rd.**

A/Prof PAUL ADAM

School of BEES, University of NSW

**THE TRUTH, THE WHOLE TRUTH AND NOTHING BUT THE TRUTH?
THE USE OF LANDSCAPE ART AS A SOURCE OF INFORMATION IN HISTORICAL ECOLOGY**

Historical ecology is a growing field.. One source of evidence may be provided by historical landscape paintings. In Australia, Gammage has used landscape paintings as one of his sources for reconstructing the pre European pattern of vegetation across the whole of Australia. His theory has been used to advocate particular approaches to fire management. There are however difficulties with treating art works as 'accurate' records, and the magnitude of these problems is poorly appreciated. To regard landscape painters as the 'photographers' of their day is inappropriate, but even photography presents issues when used as a source of information.

Refreshments will be served from 5.30 pm
Everyone welcomed