

LINN S C NEWS

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NEW MEMBERS: We welcome:

Mr Jeremy K Day of Newcastle University. Fields of interest: marine ecology, marine sanctuary zones, temperate reef ecology, benthic predators, acoustic tagging.

Miss Alyssa K Fjeld of Macquarie University. Fields of interest: invertebrate marine fauna from the Palaeozoic, biostratigraphy.

Prof Ross Street and Mrs Margery Street. Field of interest: conservation



THE LINNEAN SOCIETY'S AGM FOR 2021

The 146th Annual General Meeting was held at the Royal Botanic Gardens, Sydney, on Wednesday 24 March 2021 at 6:00pm. The President reported on the affairs of the Society and the Treasurer presented his report for the year 2020. Results of the elections for President, members of Council and auditors for 2021-22 were declared. New Council members Peter Olde and Ian Hill were introduced and welcomed. The Presidential Address *Mining, metals and the transition to a lower-carbon future* was delivered by last year's President Mr John Barkas (this Address was to have been presented at last year's AGM but was held over due to COVID-19). The 16 members and friends in attendance were treated to an in-depth analysis of facts regarding the true nature of the global demand for various metals and how their processing requirements influence current and future usage of fossil fuels and new technologies.



ARTICLES RECENTLY PUBLISHED in volume 143, 2021

Timms, B. V. 2021. A new species of fairy shrimp *Branchinella* (Crustacea: Anostraca: Thamnocephalidae) from Alice Springs, Australia.

All recent papers published in the *Proceedings* (from Vol. 133) are freely available from:

<http://ojs-prod.library.usyd.edu.au/index.php/LIN>

Earlier volumes are available from: www.biodiversitylibrary.org/bibliography/6525

Please check regularly the Society's home page for recently uploaded papers by going to "linneansocietynsw" then click "Journal (Proceedings)".



AWARDS FROM THE SCIENTIFIC RESEARCH FUNDS

The current very low interest rates limit funds available and your Society is unable to fund as many applications as it would like or to provide the full amount requested by the applicants.

William Macleay Fund for Microbiology Research

Stewart, Ms Jana (University of New South Wales). Project title: *Soil microbial responses to reintroduced semi-fossorial mammals: a temporal comparison of soil biodiversity and ecosystem function.*

Soil microbes are important drivers of ecosystem function and biogeochemical processes in drylands. However, biodiversity declines in drylands due to high extinction rates and many species threatened, has disrupted the biogeochemical processes that sustain these systems. Understanding interactions between the soil microbial community and key ecosystem engineers is needed to achieve restoration. Burrowing and digging mammals have been shown to be powerful ecosystem engineers with their foraging behaviour and burrows providing many benefits such as dispersing soil nutrients, refugia for other species, and increasing landscape heterogeneity. Previous studies have compared habitat and microbial abundance with and without these engineers showing that there is variance. However, evidence of functional diversity differences is lacking. Understanding these differences may help understand how ecosystems benefit from these interactions and also how it would be impacted if one of these pieces is altered. This project aims to understand the interactions between soil microbes and burrowing mammals on a temporal and spatial scale. Utilising the Wild Deserts project site at Sturt Desert National Park we will sample soil from reintroduction enclosures and control sites adjacent to the enclosures to assess their microbial composition and functional diversity, along with soil physicochemical properties. We aim to build 16S rRNA gene libraries and co-relate them with the soil chemical variables, to assess the impact of biodiversity loss on these microbial communities and the ecosystem functions they provide. Awarded \$2,000

Betty Mayne Fund for Scientific Research in Earth Sciences

Gale, Mr Stephen (University of Sydney). Title of Project: *The age and origin of the Botany Sands of southeast Australia*

Aeolian sands are common along the eastern seaboard of Australia. Although most form coastal dunes of interglacial age, aeolian activity may also have occurred under terrestrial conditions during the dry, cool, windy and continental environments of the last glacial. These cold-stage deposits are small, however, and largely restricted to the localised reworking of existing sand

bodies. Given this, the accumulation of aeolian sand in the Botany Basin presents us with a dilemma. The sands form a terrestrial dunefield, but dating is poor and little is known of the conditions under which deposition occurred. A single date is indicative of deposition during the penultimate glacial stage (MIS 6). This is succeeded by a handful of ages from the last glacial (MIS 3-2). Yet most of the dates on the Botany Sands are of Holocene age. Despite this, stratigraphic evidence suggests that much of this recent deposition is a consequence of small-scale disturbance and reworking of the sand sheet, and that the bulk of the sand accumulation took place under terrestrial conditions during low sea-level, glacial times. To clarify the timing and environment of its deposition, therefore, this project aims to date the earliest part of the Botany Sand body. Awarded \$1,600

Joyce W Vickery Fund for Research in Biological Sciences

Davis, Miss Kaytlyn (Macquarie University). Project title: *Investigating the utility of filter feeding organisms in the collection of environmental DNA.*

The use of meta-barcoding to sequence environmentally sourced DNA (eDNA) is an emerging tool that enables wildlife managers to obtain ecosystem-wide estimates of biodiversity. However, various limitations remain that limit the application of eDNA to challenging environments, such as wetlands with high concentrations of particulates in the water column. DNA degrades quickly in aquatic environments and large quantities of water may be required to be able to detect rare species, which may not be possible for water samples that clog filter membranes. While modified sampling and DNA extraction methods improve the ability to filter large quantities of challenging water samples, novel approaches using filter-feeding organisms may provide another means of collecting eDNA from the environment. In this study, we aim to determine whether oysters retain eDNA in their filter-feeding tissues or expel eDNA back into the environment. The outcomes of this project will help assess whether native filter-feeders could be used to deploy 'biological eDNA collectors' in challenging ecosystems and improve biodiversity estimates from water samples for these environments. Awarded \$1,000

Day, Mr Jeremy (University of Wollongong). Project title: *Food web characteristics of urchin barrens habitats; Who is in control?*

Worldwide, sea urchin populations and the algae limited 'urchin barrens' habitats they are associated with have become a topic of concern among researchers. In areas of Tasmania and New Zealand where urchin populations have grown in number or undergone range extensions with warming waters, barrens formation has been effectively mitigated by ensuring populations of the lobster *Jasus edwardsii* (Southern Rock Lobster), which eats urchins regularly. However, in NSW, where urchin barrens are widespread, no similar agent of control has been identified. Previously, the common NSW lobster species *Sagmariasus verreauxi* (Eastern Rock Lobster) has been assumed to similarly control sea urchin populations, though recent work indicates that *S. verreauxi* may eat urchins with moderate frequency by comparison with the Southern species. More work is now needed to thoroughly investigate the importance of urchins in the diet of *S. verreauxi*. While a range of other species including *Achoerodus viridis* (Blue Groper), *Pagrus auratus* (Australian Snapper) and *Heterodontus portusjacksonii* (Port Jackson Shark) are also recorded to eat sea urchins, the contribution of each species to the control of urchin populations is unknown. We now propose to determine the importance of sea urchins in the diets of these four predators through Stable Isotope Analysis, in-situ feeding trials and analysis of eDNA. This work will be a continuation of our previous research in 2019/2020, where the initial assessment of *S. verreauxi* as an urchin predator was undertaken. Awarded \$2,500 in memory of the late Surrey Jacobs.

Harris, Miss Rosalie (Australian National University). Project title: *Photosynthetic thermal tolerance of widespread temperate canopy-forming macroalgae*

Loss and decline of macroalgal forests is a global phenomenon due to climate change-induced warming and extreme events. Despite the implications of loss, relatively little is known about the mechanistic underpinnings and the physiological response of macroalgae to extreme warming. Indeed, to date there has been no common and comparable metric to allow comparison and prediction in macroalgal thermal tolerance research. My PhD will address this critical knowledge gap by applying new high through-put techniques adapted from terrestrial plant ecophysiology to improve understanding of photosynthetic thermal tolerance that will be fundamental to predicting dieback events. This will allow identification of vulnerable populations and will inform effective management of these forests into the future. Awarded \$1,800 in memory of the late Surrey Jacobs.

Liang, Miss Stephanie (University of Sydney). Project title: *How are egg-laying, live bearing, and a transitional form of pregnancy maintained in one Australian lizard species?*

Viviparity (live-birth) has independently evolved more times in squamate reptiles than any other vertebrate group. In a few rare instances (<10), within a species, individuals in some locations are oviparous (egg-laying) and others are viviparous (live-bearing) – termed bimodal reproduction. *Saiphos equalis* (three-toed skink) lives in south-eastern Australia and is unusual because it has three naturally occurring reproductive forms: oviparity with long egg-incubation, oviparity with short egg-incubation (thought to be ‘transitional’ between oviparity and viviparity) and viviparity. My previous research determined that there is strong population structuring between locations with different reproductive phenotypes. I will investigate how these phenotypic differences are maintained by high resolution sampling of lizards along a single transect in northern NSW spanning both oviparous and viviparous populations. This work will reveal the drivers of population differences to understand how multiple reproductive forms are maintained within the same species. Awarded \$1,500

O'Hare, Mrs Jessica (Macquarie University). Project title: *DNA Barcoding for molecular species identification of Western Australian and New South Wales scallops*

In both New South Wales and Western Australia, bivalve farmers (rock oyster, pearl oyster and mussel farms) have reported the natural settlement of wild scallops. The observed scallops are suspected to be the doughboy scallop (*Mimachlamys asperima*), however significant levels of morphological plasticity make it impossible to conclusively classify specimens to the species level using morphological characteristics alone. This research project will use DNA barcoding of the 16S gene to conclusively identify the species of scallops observed in Western Australia and New South Wales. We will also compare the genetic relationship between east and west coast specimens and determine whether there are major difference in haplotypes between locations. Through collaboration with taxonomic experts, the morphological characteristics of each identified species will be documented, with the shells of all specimens to be retained within museum collections. The second part of this project will generate publically accessible sequence data for the 16S gene (150 scallops) and CO1 gene (100 scallops), providing reference data to support future studies on species identification, biomonitoring and phylogenetic relationships in the Australian region and beyond. This will facilitate future eDNA biomonitoring studies. Shells will be retained in Museum collections. Awarded \$1,470

Smart, Miss Hannah (University of Western Sydney). Project title: *Bringing out the big guns: The defensive weaponry of Australian termite soldiers*

Animals have evolved a multitude of defence mechanisms, ranging from morphological adaptations to extreme chemical defences. In some of these extreme defences individuals forcibly eject a defensive substance at a potential predator, in what we refer to as a ballistic defence strategy. A well-known example of this type of defence can be seen in bombardier beetles that eject a hot, noxious chemical spray in response to predator contact. Morphological and chemical aspects of ballistic defences are relatively well-studied, but the behavioural components, such as under what circumstances their guns are used, are poorly understood. Australian snouted termites, *Nasutitermes*, (Termitidae: Nasutitermitinae) employ a ballistic

defence where they eject a noxious, glue-like substance at potential enemies from a specialised weapon on their head, known as a fontanellar gun, causing irritation and immobilisation. Common in NSW and ACT, *Nasutitermes exitiosus* provide an excellent model system to understand the conditions under which the soldier fire their guns. Using behavioural assays, we will subject soldiers to 5 treatments, measuring the termite's defensive response to a variety of tactile and visual stimuli. This project will provide crucial missing data to our understanding of this defence and build *Nasutitermes* into a model system for understanding ballistic defences. Awarded \$795 from the John Noble bequest.

Smith, Ms Tessa (University of Tasmania). Project title: *The biogeography of Tasmanian leaf-litter dwelling beetles*.

Despite their importance to global biodiversity, knowledge of beetle communities remains low. To understand the effects that environmental changes will have on diversity of beetles, we need to understand the spatial distribution of biodiversity of beetles, as well as the historical and ecological factors that control those patterns of distribution. The project aims are: to determine distributions of leaf-litter beetle dwelling species in Tasmania; to analyse the genetics of a select set of species and investigate historic processes on gene flow between different populations of beetles; to identify areas of high leaf-litter diversity and its relationship with presence of other taxa (mammals and plants) and location of current protected areas; to identify impacts of climate change on leaf-litter beetle habitats, through species distribution modelling. So far, 50 sites around mainland Tasmanian wet forests and rainforests have been sampled for leaf-litter beetles yielding over 10 000 beetles. I would like to add samples from the remnant wet forest and rainforest areas of Flinders Island in the Bass Strait. Flinders Island was connected to mainland Australia and Tasmania during periods of lower sea levels. Due to its unique position as a stepping stone between the Australian mainland and Tasmania, investigating the invertebrate fauna of Flinders Island will give a context to fauna that exists in both other areas. Awarded \$1,372 in memory of the late Surrey Jacobs.



REPORT FROM PAST RECIPIENT OF RESEARCH GRANTS

It is a condition of an award that the recipient reports the results to the Society. Some have had their works published and others are preparing papers for publication.

Jorge Rodriguez Monter (Australian Museum, Ph.D. student; 2019 Joyce W Vickery recipient). Title of project: *Biodiversity of intertidal marine flatworms (Polycladida, Platyhelminthes) in southeastern Australia*.

Marine flatworms of the Order Polycladida are a conspicuous component of Australia's marine fauna yet they have received little attention. Less than 30 scientific articles have been published on Australian marine flatworms since 1855, of which only nine include species from southeastern Australia. My research focuses on studying the biodiversity and distribution of species belonging to this group inhabiting intertidal rocky beaches in New South Wales and Victoria. The funds provided to me by the Joyce W Vickery Scientific Research Fund were employed to pay for sequencing of five genetic markers required to describe a total of 20 species, six of which are new to science (e.g., *Eulatocestus australis* sp. nov.), and a new genus (*Parabolia* gen. nov.), as well as two new records for Australia (e.g., *Stylochoplana clara* Kato, 1937), increasing our knowledge of this important component of the Australian marine biota. The results have been submitted for publication in *Zootaxa* in a monograph representing the first extensive study on southeastern Australian polyclad flatworms, including morphological and molecular data. I would like to express my deep gratitude to the Linnean Society of New South Wales for their generous support towards the completion of this project.



This is a portrait shot of the polycladid species *Thysanozoon brocchii* from Inverloch, Victoria.



NATURAL HISTORY SYMPOSIUM 2021 – UPDATE

As previously advised in Linn Soc News, this year's Symposium organized by the Society on the topic Natural History of the Northeastern Sydney Basin will take place on Wednesday October 27 and Thursday October 28 at the Hornsby RSL Club, close to Hornsby Station in northern Sydney. A full-day field excursion focusing on Ku-ring-gai National Park will be held on Friday October 29. Planning is well under way and the First Circular (which has been delayed while uncertainties remained on social distancing that affected booking of rooms and bus hire) will shortly be issued.

Please start planning presentations that you can contribute to this symposium. As in our previous symposia, we anticipate a mixture of talks by established scientists on their specialities, together with presentations by students giving details of their current research. Timing of the symposium is ideal for students coming to the end of their Honours or Masters thesis projects, and we look forward to hearing their results. We also very much welcome presentations from citizen scientists and members of local environmental organisations concerned with the preservation of the region's valuable natural heritage. Talks will be approximately 20 minutes each including questions (some keynotes will be allocated a longer timeslot).

NEED A TAX BREAK?

Donations to our scientific research funds are fully tax deductible

The Joyce W Vickery Scientific Research Fund

Is open to anyone engaged in research in natural history. Over eighty projects have been supported in the last five years.

The Betty Mayne Scientific Research Fund in Earth Sciences

Supports projects in geology and other earth sciences. Sixteen awards have been made in the last five years.

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