

LINN S C NEWS

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NEW MEMBERS

We welcome our new members:

Mrs Yvette M Bauder ; Mr Andrew Berg ; Mr Russell D C Bicknell ; Mr James D Collison ; Dr Laetitia M Gunton ; Miss Rosalie J Harris ; Mrs Jane Judd ; Dr Espen Knutsen ; Mr Farhad Masoomi-Aladizgeh ; Mr Geoffrey Mazue ; Mr Jorge R Monter ; Mr Matthew Nicholson ; Mr Gerrut Norval ; Mr Michael Roffe ; Ms Emma E Sumner ; Mr Carl Watson ; Dr Peter H Weston ; Ms Zoë T Wyllie

AWARDS FROM THE SCIENTIFIC RESEARCH FUNDS

The current low interest rates limit funds available and the Society is unable to fund as many applications as it would like or to provide the full amount requested by the applicants. Decisions on where to make the cuts have been made difficult and disappointing because worthwhile projects go unfunded owing to the present state of the economy.

WILLIAM MACLEAY MICROBIOLOGY RESEARCH FUND

Report from the William Macleay Committee:

Ghaly, Mr Timothy (PhD candidate, Macquarie University)

Title of project: *The genesis, diversity and dynamics of integron gene cassettes.*

Synopsis. Integrons are bacterial genetic elements that promote rapid adaptation by capturing and expressing mobile genes known as gene cassettes. Recently, a subset of gene cassettes has facilitated the global spread of antibiotic resistance. However, it is clear that gene cassettes collectively encode a much broader range of traits that can confer an advantage to diverse selection pressures. Importantly, the mechanisms by which gene cassettes are generated, and

thus made available to integrons, and in which taxa this is occurring, remains completely unknown. This project will address this by using a combination of innovative experimental and computational approaches. The outcomes of this work will help solve a question that has remained unanswered since the discovery of integrons more than 30 years ago – How do gene cassettes arise? Solving this problem will add significantly to our understanding of bacterial genome evolution, and will pave the way for developing methods for controlling and manipulating integron activity. **Granted: \$1,200**

Watson, Mr Carl (BSc Student, Flinders University)

Title of project: *Captivity, translocation, and gut bacteria in the pygmy bluetongue lizard.*

Synopsis. One way in which animals can respond to climate change is by moving with the climate shift and staying within their optimal climatic range. However, habitat destruction has left many animals in fragmented populations, limiting their ability to migrate, and subsequently threatening their survival. With 7.9% of existing species predicted to become extinct due to the effects of climate change, direct human intervention is often required to limit these losses. Microbes, and specifically bacteria, are found in association with all plants and animals, and have been shown to be important for a range of functions including; nutrition, immune response, development, host behaviour and general health. The pygmy bluetongue lizard (*Tiliqua adelaidensis*) is an endangered skink endemic to the Mid-North region of South Australia. It is found exclusively in remnant grasslands dominated by native grasses, where it lives in spider burrows. The major threat to the species is habitat destruction for agricultural use, as well as for infrastructure such as roads and wind turbines. The pygmy bluetongue was thought to be extinct for 33 years, until 1992 when a specimen was discovered in the stomach of a brown snake at Burra, South Australia. Research into the suitability of the pygmy bluetongue to translocation has been continuing for more than 10 years. I will examine the composition of the gut bacterial communities of lizards both before and after release from captivity. **Granted: \$800**

BETTY MAYNE SCIENTIFIC RESEARCH FUND FOR EARTH SCIENCES

Report from the Mayne Committee:

Bauder, Mrs Yvette (MSc candidate, Macquarie University)

Title of project: *Foraminifera as indicators of anthropogenic change on the Great Barrier Reef.*

Synopsis. This project aims to determine the history of foraminiferal assemblages over the past +/- 600 years at One Tree Reef, Great Barrier Reef. Foraminifera, benthic unicellular protists, are fundamental components of reef systems that have been shown to be sensitive to the same factors threatening coral viability. Foraminifera are valuable carbon sinks, producing 25% of oceanic carbonate, and a major sediment source for coral cays. The Great Barrier Reef is the world's largest reef system, and by virtue of its size, one of the most diverse. Annual sea-surface temperatures have risen through the 1900's and land clearing commenced in the 1800's with evidence suggesting the reef has been in decline over the last 100 years. It is possible that there will be no significant change in foraminiferal assemblages over the past 600 years as One Tree Reef is quite remote, but it is also possible that even the outer reefs of the GBR have been impacted by the colonisation and industrialisation of Australia. Changes through the core may relate to taphonomic trends and/or global factors. Assemblages from the core will be compared with surficial samples. **Granted: \$380**

Bicknell, Mr Russell (PhD candidate, University of New England)

Title of project: *Origin, diversity and disparity of horseshoe crabs.*

Synopsis. One of the most iconic arthropod groups alive today are the large archaic looking taxa within Xiphosurida—the so-called horseshoe crabs. The group has interested palaeontologists over the past century with a spectacular fossil record that extends from the lower Ordovician to today. Despite the well-known status of horseshoe crabs, the extent of their more recent static morphological evolution and the origin of this successful *Bauplan* remains unquantified.

Australian fossil horseshoe crabs represent some morphological extremes and therefore stand as evidence against the conserved nature of the group. The proposed application involves a research trip to visit the four collections containing holotypes of the Australian taxa: Australian Museum, NSW Geological survey, Museums Victoria and Tasmania University Geological Collection. The ultimate outcomes of the funded research will be publications that will set the standard for explaining why horseshoe crabs have not changed dramatically since the Jurassic and highlight the uniqueness of Australia's disparate horseshoe crabs. **Granted: \$1,000**

Wyllie, Ms Zoë T (MSc candidate, Macquarie University)

Title of project: *Taphonomic study of Placodermi and Sarcopterygii of the Canowindra fauna.*

Synopsis. Canowindra in central west NSW is home to a unique death assemblage of extinct Devonian fishes, called the Canowindra Fauna. The death assemblage occurs within the Mandagery Formation, which is normally considered Late Devonian (Frasnian) in age. The Canowindra Fauna is considered a Konservat-Lagerstätten (or exceptional preservation) and whilst the taxonomy of most species has been published, there has been almost no detailed analysis of the taphonomy and depositional environment of the deposit. The surrounding geology indicates modern day Canowindra was in proximity to the Devonian east coast and was part of an extensive freshwater river/stream system, probably with interconnected billabongs and lakes. The coastal environment of the Devonian east coast of Australia was teeming with fishes including families that have since become extinct, though no fish fossils sites in the region provide the exceptional preservation of the Canowindra Fauna. The aim of this thesis is to understand the characteristics of the Canowindra Fish Fauna death assemblage. The main goal is to ascertain if the two dominant placoderm species in the fauna (~90%) represent one or more size classes. Additionally, targeted thin sections through external dermal bone will add important new histological data about the placoderms and lithological thin sections of the rocks surrounding the fish will provide the first detailed sedimentological analysis of the death assemblage.

Granted: \$460

JOYCE W VICKERY SCIENTIFIC RESEARCH FUND

Report from the Vickery Committee:

Armansin, Ms Nicolette (PhD candidate, Macquarie University)

Title of project: *Are threatened species in the catch? Genetic identification of sharks traded and consumed in Australia.*

Synopsis. Large quantities of 'flake' are consumed in Australia, and despite rising public support for sustainable seafood, there is little information on the species currently being traded under this name. We have over 4,000 'fish and chip' shops, and many more restaurants and supermarkets selling flake. Flake is thought to be comprised of two species of gummy shark (*Mustelus antarcticus* and *M. lenticulatus*), considered a sustainable fishery in Australian and New Zealand. However, the capture of gummy shark is known to carry substantial bycatch of school shark (*Galeorhinus galeus*), which have been significantly depleted by overfishing. Further, any species of shark can be traded as flake. Given the quantity of flake consumed nationally, even small proportions of threatened species bycatch can have sustainability implications. My preliminary investigations indicate that retailers are selling around 100 species as "flake" across Australia. I predict that some of these species are threatened. To test this, I aim to identify species composition of flake sold nationally using DNA barcoding. Eight hundred and fifty individual shark flesh samples have already been collected from local and national vendors across Australia. This is the first national study of species composition of flake and I aim to publish the results in a peer-reviewed scientific journal. **Granted: \$1,000**

Berg, Mr Andrew (BSc honours student, University of Sydney)

Title of project: *Evolutionary history of the now extinct Tasmanian southern elephant seals.*

Synopsis. This project is to use ancient DNA techniques to sequence DNA from now extinct putative southern elephant seal colonies from Tasmania. These charismatic marine mammals are present in the Tasmanian fossil record at several sites, including King Island, and the South Point midden. The earth's environment has been constantly changing. Despite this, there is global concern about future climate change and human contribution. At that time, the change at the Poles was extreme; the average temperature in Antarctica rose by ~10 C, whereas the temperature difference in Greenland was even greater; temperature increased by 15 C between the Younger Dryas (12,900-11,500 YBP) and the early Holocene (11,500-10,000 YBP). A multi-population Isolation-with-Migration model will be implemented in IMA to estimate effective population sizes, time of splitting, and migration rates between populations of each target taxon. This research will build on previous research by Dr Mark de Bruyn (supervising this project) that used ancient DNA methods to characterise a now extinct southern elephant seal colony from the Victoria Land Coast, Antarctica. **Granted: \$500**

Buddle, Miss Alice (PhD student 2nd year, University of Sydney)

Title of project: *The evolution of placentas in sharks: how does the shark placenta facilitate exchange of gases, water and nutrients during pregnancy?*

Synopsis. My aim is to describe and understand the mechanisms underlying major placental functions in the Australian Sharpnose shark (*Rhizoprionodon taylori*). A placenta has evolved in five families of sharks (requiem sharks, hammerhead sharks, weasel sharks, barbeled houndsharks and houndsharks). While we know that shark placental formation is critical to embryonic growth and development, placental structures that are specialised for transporting nutrients, water and respiratory gases remain unknown. The current lack of data on placental function in sharks limits our ability to predict the adaptability of sharks to anthropogenic threats such as climate change and overfishing. My project will address this lack of knowledge by using the Australian sharpnose shark as a model for shark placental function. Placental sharks gain the nutrients they require to complete embryonic development from three major sources: nutrients contained in the yolk of the egg, nutritive uterine secretions and nutrients supplied across a placental connection. Most embryonic sharks develop inside of their mother but are primarily reliant on yolk stores for embryonic nourishment and do not form a placenta. The Australian sharpnose shark is an ideal model species to investigate placental function and mechanisms for foetal nutrition during shark pregnancy because it sequentially nourishes young by yolk, uterine secretions and a placenta. **Granted: \$800**

Cutmore, Dr Scott (Research Fellow, University of Queensland)

Title of project: *Cryptic biodiversity on the reef: trematodes in butterflyfishes.*

Synopsis. Parasitic trematode flatworms are exceptionally diverse in marine systems globally, infecting an incredible range of fishes from the warm, shallow waters of the tropical coral reefs to the cold depths of the deepest oceans. As with other parasite groups, the discovery and description of trematodes has lagged substantially behind that of their more conspicuous and more charismatic hosts. However, understanding how many trematodes infect marine fishes is essential when estimating total marine biodiversity. Cryptic species are particularly a problem within the trematode family Faustulidae. The Faustulidae comprises species that infect a diverse range of freshwater and marine teleost fishes; members of the 13 marine faustulid genera infect an impressive 15 orders of fishes. A recent molecular investigation of the "*Paradiscogaster glebulae* complex" found that collections of this one species from butterflyfishes on the Great Barrier Reef actually represent six genetically distinct species. **Granted: \$800**

Gunton, Dr Laetitia (Research Fellow, Australian Museum)

Title of project: *Biogeography and phylogeny of Australian eastern abyssal ampharetids.*

Synopsis. The project will focus on the family Ampharetidae, one of the most abundant annelid families collected in the Australian eastern abyss. The proposed project will use annelid samples collected from the pioneering RV Investigator expedition 'Sampling the Abyss' in 2017, the first dedicated deep-sea cruise to sample along the eastern Australian coast, from Tasmania to

Southern Queensland. Before the cruise, there was no biological data from abyssal communities in Australian Commonwealth Marine Reserves. All annelid samples have been identified to species or operational taxonomic unit by the Principal Investigator (Laetitia Gunton) and collaborators. The funds requested from the Linnean Society of NSW will be used towards a much larger two-year project on annelid genetic connectivity throughout the eastern Australian deep sea. Funding has been secured from the Australian Museum for part of the molecular analysis (100 specimens). I am seeking further support from the Linnean Society of NSW for further molecular analysis (37 specimens) and SEM imaging (20 specimens). We aim to describe the species distribution and genetic connectivity of marine annelids within the eastern Australian deep-sea biome along a latitudinal (24-44°S) and bathymetric (300-6500 m) gradient.

Granted: \$1,500

Harris, Miss Rosalie (MSc student, Australian National University) [*Surrey Jacobs Award*]

Title of project: *Key predictors of macroalgal biodiversity within the World Heritage Ningaloo Reef*

Synopsis. Tropical coral reefs are hyper-diverse ecosystems with a dense aggregation of species that are at considerable risk due to local impacts and climate change. Three major groups of habitat-forming organisms tend to dominate these tropical coastal systems: seagrasses, corals and macroalgae. Drivers and threats to the biodiversity of corals and seagrasses have received increasing attention over recent decades, yet comparatively little has been dedicated to uncovering the wealth of diversity present within tropical macroalgal communities. As a major group of marine primary producers, macroalgal communities play an essential role as facilitators of food security, habitat and breeding grounds for an abundance of organisms. We still do not know the extent of macroalgal biodiversity let alone the key drivers that determine its structure. Therefore, our current understanding of macroalgae community structure is based upon fundamental assumptions that must be tested in order for us to fully comprehend. Only with field based testing can we start to unravel this complexity, to start to explain why these seaweed meadows occur where they are, why they change through time and the possible effects, such as their resilience to natural disturbance events. **Granted: 1,500**

Jones, Mr Braxton (Research student, Macquarie University)

Title of project: *A phylogenetic study to uncover the ecology of arid stick insects.*

Synopsis. Climate modelling predicts an expansion of arid landscapes and with it an increase in extreme temperature shifts. To gain such insight a faunal group is required that has species delineated by biomes that transition from the tropics to arid environments. A promising faunal group for such an investigation are the Phasmatodea (stick insects). My aim is to reveal the evolutionary history of two grass feeding genera and in doing so uncover their path of trait development that has led to occupying harsh environments. Despite stick insects being well known by the general public and bred by many enthusiasts, there is relatively little known about their natural ecology. A major barrier has been the poorly resolved taxonomic relationships of stick insects with many species yet to be described. Of all the known genera *Denhama* and *Hyrtaeus* are possibly the most incomplete due to their striking cryptic appearance. The objective is to undertake a complete phylogenetic treatment and taxonomic revision of two, grass feeding genera of stick insects, *Denhama* and *Hyrtaeus*. These genera have species occupying different biomes extending from tropical to temperate and to arid zones. Therefore, this collaboration is considered important for national significance of Australia's changing environments.

Granted: \$500

Louvard, Miss Clarisse (PhD student, University of Queensland)

Title of project: *The Mystery Hosts: Investigating the role of planktonic pelagic molluscs in parasitic transmission to large Australian pelagic fishes.*

Synopsis. Trematodes (flukes) are parasitic Platyhelminthes with complex life cycles involving multiple, often highly specific intermediate and definitive hosts. Trematodes of the superfamily Hemiuroidea are particularly prevalent in large, commercially important pelagic

fishes such as true tunas (*Thunnus* spp.). Although the life cycles of some hemiuiroids infecting near shore fishes are known, I aim to comprehensively document the trematode richness in pelagic molluscs in Australian waters. Hemiuiroid trematodes have complex life cycles involving 3–4 hosts. Larval hemiuiroids infect a first intermediate snail host and are later transmitted along the food chain until consumed by their definitive fish host. As such, hemiuiroids from the families Didymozoidae, Hirudinellidae, Sclerodistomidae and Syncoeliidae are major endoparasites of pelagic fishes such as true tunas (*Thunnus* spp.), flying fishes, marlin and mahi mahi. Despite the magnitude of hemiuiroid richness in pelagic fishes, information about their life cycles is almost nonexistent. I aim to comprehensively document the trematodes infecting pelagic molluscs in Australian waters. Previous work in Australian waters shows that pelagic molluscs are widely distributed off the Queensland coast. A pilot survey conducted by myself and the University of Queensland Marine Parasitology Laboratory and me at Lizard Island in November 2018 confirmed their presence in that area. **Granted: \$700**

Masoomi-Aladizgeh, Mr Farhad (PhD candidate, Macquarie University)

Title of project: *Wild cotton (Gossypium robinsonii) from the deserts of Australia: a tool for more environmentally friendly cotton crops*

Synopsis. The wild cotton in this proposal has a genome about a third the size of a human cell but until recently, sequencing an Australian cotton would have been unthinkable. As our climates change rapidly, there is now a growing focus on resilience through broader genetics. *Gossypium hirsutum* arose from a cross between two American species, *G. arboreum* and *G. raimondii*. However, none of the genetics of Australia's seventeen wild cotton relatives has been used to build further resilience, specifically, tolerance to extremes of heat, drought and damage from excess light. The only chance of identifying the rare alleles (gene variants) in wild cotton from the Australian arid-zone is to interrogate the genomic sequences of these plants using novel sequencing methods. This project aims at assembling a preliminary sequence of an Australian wild cotton species. DNA will be extracted from *G. robinsonii* and chopped into short nucleotide fragments which can then have their base pairs sequenced by GSS. Publicly available informatics software will enable us to partially re-assemble the whole sequence of each chromosome, as though the shards of a broken vase were being reassembled by each part informing the position of a neighbouring fragment. **Granted: \$500**

Mazue, Mr Geoffrey (PhD student, University of Sydney)

Title of project: *Information transfer and social benefits in the invasive mosquitofish (Gambusia holbrooki)*

Synopsis. This research project aims to quantify information transfer within animal groups to determine how social information enhances the accuracy of group decision making during navigation and foraging in a novel environment. Like many species of insects, birds and mammals, a large proportion of fish species benefit from aggregating with conspecifics. Across a variety of contexts (e.g. anti-predation behaviour, social foraging or group navigation), the benefits of shoaling depend on a group's ability to consistently make cohesive, fast and accurate decisions, in order to minimize the risk of predation and maximize foraging success. Eastern gambusia (*Gambusia holbrooki*), often referred as mosquitofish, are native to Central America. Introduced to NSW during the 1920s in an attempt to biologically control mosquito populations, mosquitofish are known today as a well-established pest fish species, widespread throughout Australia, and several countries around the world. Although it competes with native species for food and resources, little is known about the social behaviour of mosquitofish, and in particular, what makes groups of mosquitofish so efficient at exploring and dispersing in previously uninvaded waterways. This project, although it emphasizes on the information flow, belongs to a larger research program developed by the laboratory of Professor Ashley Ward that aims to understand the underlying mechanisms of collective behaviour in the Eastern mosquitofish (*Gambusia holbrooki*). The use of high-resolution spatial data combined with the novel analytic tool, transfer entropy, offers a unique opportunity to understand the role of information transfer

in mobile groups. Furthermore, the use of a highly invasive species for this project would mark an important step towards identifying the role of sociality in the success of an invasive species.

Granted: \$600

Norval, Mr Gerrut (PhD candidate, Flinders University) [*Noble Award*]

Title of project: *Does the haemogregarine parasite, Hemolivia mariae, infect the kangaroo soft tick (Ornithodoros gurneyi) at a study site near Mt. Mary, South Australia?*

Synopsis. The sleepy lizard (*Tiliqua rugosa*) is a common large skink species in coastal heath, dry scrubland, grassland, dry woodland, dry sclerophyll forest, chenopod shrubland, mallee, *Acacia* and eucalypt scrubland, gibber plain and spinifex-dominated sandy desert habitats of most of southern Australia. Throughout its range, *T. rugosa* has been reported as a host of a variety of parasites. Apart from the research pertaining to the two ticks and the haemogregarine parasite, *Hemolivia mariae*, which they infect the lizards with, surprisingly little is known about the parasite community of this sleepy lizard population. Ticks are parasitic arthropods that feed on the blood of non-aquatic vertebrates. Through the feeding process, in addition to anaemia, they can also cause dermatosis, tick paralysis and/or otoacariasis, and are often also vectors for various pathogens. During the course of a preliminary study in 2017 I sampled immature stages of the kangaroo soft tick (*Ornithodoros gurneyi*) that were found parasitising sleepy lizards. Apart from speculations of kangaroo soft ticks as vectors for *Borrelia queenslandica* and *Coxiella burnetii*, nothing is known about their role as a vector for pathogens. The aims of this study are as follows: to determine the prevalence of infections by *H. mariae* in the lizards sampled across the ecological gradient and to determine whether the prevalence of this parasite in these ticks.

Granted: \$1,000

Rodriguez Monter, Mr Jorge (PhD candidate, Macquarie University)

Title of project: *Biodiversity of marine flatworms in south-eastern Australia*

Synopsis. Polyclad flatworms are a group of marine, free-living invertebrates found in all kinds of habitats, including coral reefs, rocky shores, soft bottoms and deep-water. Worldwide over 900 species are currently known. Marine flatworms are a conspicuous component of Australia's marine biodiversity yet less than 20 scientific articles have been published on Australian marine flatworms since 1898, of which only seven include species from south-eastern Australia. With no active researchers in the country working on this particular taxon, this project represents a great opportunity to increase our knowledge on an often overlooked but very interesting group of animals. Creating an inventory and an identification key to the polyclad species inhabiting Australian waters is crucial for understanding Australia's biodiversity and for future ecological studies. This project documents the taxonomy of south-eastern Australian flatworms through the use of a combination of morphological and molecular data sets. My goal is to establish a taxonomic key for identification and to facilitate the conservation and protection of these animals. Once the molecular part of this work is completed, I will develop interactive keys to allow easy identification for ecologists. **Granted: \$1,500**

Sumner, Ms Emma (PhD candidate, Deakin University) [*Surrey Jacobs Award*]

Title of project: *How will Australian alpine plants respond to future climate extremes?*

Synopsis. Life for alpine plants is one dominated by climate severity. There has been comparatively little research conducted on the thermal tolerances of Australian alpine plants and to date, no research has investigated heat tolerance. The objectives of this research are to (1) Provide empirical data on the upper and lower thermal tolerances of key alpine plant species; (2) Investigate how thermal tolerances vary across the landscape and across seasons; (3) Investigate how snow conditions during winter and early spring affect upper and lower thermal tolerances and growth of alpine plants. Climate in the Australian Alps encompasses both upper and lower temperature extremes: freezing events occur year-round, and heatwaves throughout the growing season. However, by 2050 precipitation is expected to reduce by 24%, drought and heatwave frequency and intensity is expected to increase with more days above 35°C and average temperatures are expected to rise by up to 2.9°C. Snow is the most important environmental

driver of species distributions and plant communities in the Australian Alps. With earlier and more variable snowmelt, it is unclear how plants will respond to exposure during winter and early spring, or how this will affect their freezing resistance and/or heat tolerances later in summer. In order to achieve my project goals, I will test the following hypotheses: (1) With elevation, heat tolerance will decrease and freezing tolerance will increase; (2) Plant thermal tolerance thresholds will adjust according to season, with greatest heat tolerance in summer and greatest freezing tolerance in spring; (3) Plants experience greatest freezing injury and reduced growth with early snow melt conditions; (4) Plants increase freezing tolerance with multiple years of early snow melt conditions. This will be the first project to encompass both ends of thermal spectrum of alpine plants in Australia and the first to investigate thermal tolerance responses across an elevation and snowmelt gradient throughout the year. Results will provide valuable information on the capacity for Australian alpine plants to respond to future climate extremes and changing snow conditions, and will identify species resilient or sensitive to ongoing climate change. **Granted: \$1,500**

Wee, Mr Nicholas (PhD student, University of Queensland)

Title of project: *The circle of life: Elucidating the life-cycles of parasitic flatworms infecting Australian bivalves and fishes*

Synopsis. Digenean trematodes are parasitic flatworms that infect all major invertebrate groups and possess complex, multi-host life-cycles. A typical digenean life-cycle involves three stages of transmission. Eggs released from the adult worm embryonate to form miracidia which seek out a first intermediate host, typically a mollusc. The miracidium develops into a sporocyst. Following asexual reproduction, cercariae, the free-living and short-lived second larval stage emerges from the mollusc and penetrates the second intermediate host which can comprise a wide range of invertebrate and vertebrates. The cercariae encyst within the second intermediate host as metacercariae and await ingestion by the definitive host for the life cycle to be completed. The Monorchiidae is a widely studied trematode family for which few larval stages, and even fewer complete life-cycles are known. The Monorchiidae is a major digenean trematode family with over 250 species infecting a wide range of marine fishes. While the group has been subjected to much research globally, much is still unknown about their life-cycles. Majority of the knowledge on monorchiid life-cycles stems from ten studies that have elucidated complete monorchiid life-cycles. The studies were mostly conducted in North America, South America, and Europe. Within Australia, however, knowledge of monorchiid life-cycles is minimal. The only available information comes from unpublished data. No monorchiid life-cycles have been elucidated in the region and it represents a significant gap in our understanding of the group. The project has primary aims of elucidating the life-cycles of monorchiids in Australia and to identify their host ranges. I propose to conduct research from Heron Island Research Station on the southern Great Barrier Reef. After collection, specimens will be processed using standard morphological techniques. A key outcome of the study is that the life-cycle will be used in analysing the parasite-host interactions, the phylogenetic relationship and the evolution of the group. This will further bolster our understanding of the interrelationships of the Monorchiidae to other digenean trematodes. **Granted: \$600**

REPORTS FROM RECIPIENTS OF RESEARCH GRANTS

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

Ms Hannah **BANNISTER** (University of Adelaide). Grant title: *Pre-European diet of the brushtail possum in the northern Flinders Ranges*. Like many other « critical weight range » mammals, the brushtail possum (*Trichosurus vulpecula*) has undergone a severe decline in the past 100-200 years, having disappeared from more than 50% of its former range, with their decline most pronounced in the arid zone. Predation by introduced foxes (*Vulpes vulpes*) and feral cats (*Felis catus*), competition with and habitat alteration by introduced herbivores and domestic stock, habitat loss, altered fire regimes and hunting are all thought

to have contributed to the « species » decline. In the *Ikara-Flinders Ranges National Park*, foxes are subject to ongoing control under the Bounceback project. This led to a trial reintroduction of brushtail possums in 2015, after their local extinction around 70 years ago. brushtail possum scats were collected from caves at Chambers Gorge, in the northern Flinders Ranges in the 1970s. The aim of this study was to analyse the contents of a subset of these scats using next generation DNA sequencing, and compare this to the diet of the reintroduced population. I am thankful to the Linnean Society of NSW Joyce W Vickery Scientific Research Fund, Field Naturalists Society of South Australia and Holsworth Wildlife Research Fund for providing funding towards this research.

Mr Yi-Yang **CHEN** (Australian National University). Grant title: *How does tropical macroalgae epifauna respond to changing sea temperature?* Epifauna are invertebrates (0.5 – 1.0 mm long) occupying the canopy of other organisms such as macroalgae and corals. As the key consumers, producers and nutrient recyclers, macroalga-associated epifaunal communities can have very high levels of secondary of secondary productivity in tropical macroalgal reefs. During 2018 I visited Coral Bay within the Ningaloo Marine Park to conduct my field assessments of *Sargassum* canopy structure, and make collections to assess patterns of biodiversity in *Sargassum* epifauna, across nine study sites during the Austral summer (Feb-Mar) and winter (Aug-Sep) seasons. Back at the ANU in Canberra, I used the sieve method to categorise the epifauna by size and functional group, from which I was able to calculate epifaunal abundance and biomass in each season. It was an amazing experience, and I am grateful to the Linnean Society of NSW for supporting my field research.

Mr Timothy **FRAUENFELDER** (University of New England). Grant title: *Exploration of the Griman Creek Formation in Bymount, southern Queensland, Australia*. The Griman Creek Formation at Lightning Ridge has one of the most abundant and diverse, yet poorly known fossil records of Cretaceous terrestrial fauna in Australia. The fauna consists of titanosauriform sauropods, megaraptoran theropods, pterosaurs, turtles, possible ankylosaurids, plesiosaurs, mammals, dipnoans and diverse freshwater invertebrates. The Griman Creek Formation at Lightning Ridge is unique on a global scale being the only locality that preserves a terrestrial fauna as natural casts in precious and non-precious opal. Given that Lightning Ridge is the main fossil-bearing locality for this formation, research on this fauna is inherently limited by mining. At the Bymount property there were at least three major finds: a juvenile plesiosaur centrum, a sauropod caudal vertebra and a possible sauropod rib. Continued fieldwork in 2019 will hopefully shed further light in the fossils that were found. A poster presentation resulted from this fieldwork and gained attention from other fellow students. A publication will be in the works after looking at already found material from previous trips not yet described.

Miss Alexandra **MURRAY** (James Cook University). Grant title: *Analysis and description of a Cretaceous ichthyosaur skull from Boulia, Queensland, Australia*. Cretaceous ichthyosaur fossils are found widely throughout western Queensland and are all assumed to be a single endemic species: *Platypterygius australis*. A specimen that has been labelled as *P. australis* but has not yet been formally described is Queensland Museum specimen QMF58949 which resides at the Stonehouse Museum at Boulia. QMF58949 consists of a near-complete skull and select appendicular skeletal elements. This funding (Betty Mayne Fund for Earth Sciences) has facilitated multiple fieldwork opportunities to Boulia to properly examine QMF58949 and produce an accurate 3D model. The results are not yet conclusive. The ultimate outcome of funded research is the publication of the formal description of QMF58949 with the aim of placing it within its taxonomic context.

PROCEEDINGS OF THE LINNEAN SOCIETY OF NSW

All recent papers published in the *Proceedings* are freely available from
<http://ojs-prod.library.usyd.edu.au/index.php/LIN>

Past volumes available from

www.biodiversitylibrary.org/bibliography/6525

NOTE: A CD is no longer distributed free

List of articles published in volume 140, 2018

- Fulton, GR. *Notes on the mammals collected on the Chevert expedition to New Guinea in 1875.*
 Maynard, GV, Lepschi, BJ, & Malfroy, SF. *Norfolk Island quarantine survey 2012-2014. A comprehensive assessment of an isolated subtropical island.*
 Spate, A, Baker, A. & Coleborn, K. *Kart values of Kosciuszko National Park – a review of values and of recent research.*
 Wright, GT, McDougall, KL & McCarthy, GJ. *Archiving the scientific legacy of Dr Alec Costin.*
 Zhen, YY. *Conodonts, corals and stromatoporoids from Late Ordovician and latest Silurian allochthonous limestones in the Cuga Burga Volcanics of central western New South Wales.*

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



SNIPPETS FROM THE PAST

28. March 1923. From the Presidential Address by Mr G A Waterhouse FES, President, in the Chair: *"Our animals have been sadly neglected; the number of the larger species is not great, and they are not of use for domestic purposes. Speaking of the marsupials alone – the fur can be put to commercial uses and as a result they have been shot to such an extent that many species have been well nigh exterminated. The scientific importance of our fauna is shown by the number of expeditions that have visited or propose to visit Australia and very soon it may be said that the best collections of some groups are to be found not in Australian museums, but in those outside Australia. This should not be so. It behoves this Society to ask how has this happened and can the position be rectified. In New South Wales there are two institutions that might be expected to take a keen interest in these questions – The Australian Museum and Taronga Zoological Park – neither of them government departments but governed by Trustees, and in both cases Zoologists are in a decided minority on the Trusts. The Australian Museum is working under an old act, but to-day the community contains many highly trained and qualified men whose services might readily be availed of. For instance, why should the Chief Justice, The President of the Medical Board, The Crown Solicitor, as such, be Trustees and not the Professor of Zoology at the University of Sydney or representatives elected by this Society or the Royal Zoological Society."*

Extract from *Annals of Botany*, 122(5): 747-756, 2018

Immobilised Plants

Recent research has shown that anaesthetics work on plants as well as humans and other animals. The research team chose plants that move – Venus flytrap, peas whose tendrils reach out to climb and the sensitive *Mimosa* whose leaves fold up when disturbed. When anaesthetised, the Venus flytrap does not close to capture insects and the tendrils and leaves do not move.

A diverse group of compounds are used as anaesthetics in humans and animals. It is not fully understood how each compound manages to immobilise the nervous system, physiologically speaking. The research team suggest that perhaps plants could be used for experiments instead of the usual mice.

ANNOUNCEMENTS

1. 2019 LINNEAN SOCIETY OF NSW BLUE MOUNTAINS SYMPOSIUM

The Society will hold a symposium from Thursday 7 to Saturday 9 of November 2019 on geology, botany, zoology, ecology. It will have three components:

- i) 7. November: a day long field trip.

ii) 8. November: a day long scientific session, will be held at the Blue Mountains Heritage Centre Govetts Leap, Blackheath.

iii) 9. November: a day long public lecture day at the Springwood Sports Club (the theatrette has already been secured for that day)

LINNEAN SOCIETY OF NEW SOUTH WALES

TREASURER'S REPORT TO ACCOMPANY 2018 AUDITED ACCOUNTS

Although the Society continues on a relatively sound financial footing, our income stream derived from interest on term deposits is now in steep decline. All our term deposits, which are invested for terms of 1-2 years, now only return less than half the interest payments we enjoyed a few years ago. This has impacted heavily on our ability to reign in the operating deficit which continues stubbornly at \$10096 last year, a slight increase from the 2017 deficit of \$9458. This is despite the benefit of a useful surplus (just over \$5300) from the Warrumbungles Symposium held in September 2018, as well as profit of \$1038 derived from continuing sales of the Royal National Park guidebook. Our major expenses continue to be the modest salary of our part time secretary, rental of the Society's office, and the annual audit fee. In regard to the latter I am pleased to report that we again successfully negotiated a significant discount in the cost of the audit thanks to the generosity of our long-term auditors. This year Council is adopting some significant measures, such as moving out of our rented office space at Kingsford, that should result in substantial savings, perhaps even eliminating the annual deficit.

The fall in interest income significantly affects the ability of the Society's scientific research funds – the Joyce Vickery Fund, Betty Mayne Fund, and the William Macleay Microbiology Fund – to maintain their important financial support of basic scientific research undertaken mainly by undergraduate and post-graduate students. As in past years we limited the total amount available as grants to 50% of the preceding year's income from interest. In 2018, grants dispersed from the Joyce Vickery Scientific Research Fund amounted to \$12,600 (including supplements from the JF Noble Bequest and the Surrey Jacobs Memorial award), which was marginally less than was disbursed in 2017. \$1700 was awarded from the William Macleay Microbiology Fund (compared to \$2600 in the previous year). The Betty Mayne Scientific Research Fund for Earth Sciences disbursed \$4059 in 2018 (compared with \$2818 in 2017) though this was substantially boosted due to the final supplement from the Tenison Woods Memorial fund. The capital of these research funds was increased by tax-deductible donations, for which the Society is most grateful.

The Society continues to support scientific research with a quality journal, free scientific talks throughout the year, significant grants to assist students and retired researchers, and an annual (or biannual) well-attended symposium. In regard to the latter I draw your attention to our 2019 Natural History Symposium to be held in early November, which will focus on the geology, botany, zoology and ecology of the Blue Mountains National Park and World Heritage area.

I thank the Secretary for his day-to-day handling of income and expenditure, and for providing me each month with accurate paperwork to facilitate my compilation of the accounts, and the Society's auditors for thoroughly checking all of the figures.

Ian Percival (Honorary Treasurer) 20th March, 2019