LINNEAN SOCIETY OF NEW SOUTH WALES

LINN S'O'C' NEWS

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IN THIS ISSUE

INCLUDED WITH THIS ISSUE

Field Guide to Royal National Park: Book launch and special offer to Members flyer

N**EW MEMBER.** We welcome Dr. Stephen B. Johnson of the Department of Agriculture. His fields of interest are weed/plant ecology, weed risk management, interface of legislation and management of weeds, policy and management of conflict (commercial) species.

CHANGE TO PROGRAM

Prof. David Mabberly is unable to give the talk on "The story of the Apple" as previously advertised. Instead, Dr. Peter Weston will talk on "The Flora and vegetation of Southern Africa". See the Program for further details.

BOOK LAUNCH AND SPECIAL OFFER TO MEMBERS

The Society has produced *Field Guide to Royal National Park*, edited by R.J. King, covering all aspects of Natural History. The book will be launched on 11 December. See the enclosed flyer for details. A special price of $10 is offered to Members.

LINNEAN MACLEAY FELLOWSHIP

Applications are invited for the Linnean Macleay Fellowship for the year 2014. Applicants must be Members of the Society, reside in New South Wales, and have a degree in Science or Agricultural Science from the University of Sydney. Applicants are required to outline the proposed research and where it will be carried out. The Fellowship pays $3,200 per annum, and the Fellow must engage in full time research on the project. The regulations governing the Fellowship are available on request from the Secretary or the Society's web site. These regulations were stipulated in Sir William Macleay's will and the Society is obliged to adhere to them.

Applications close 15 November, 2013

REVIEW OF AUSTRALIAN CICADAS

The monograph *A review of the genera of Australian cicadas (Hemiptera: Cicadoidea)* is now available on-line at http://mapress.com/zootaxa/2012/f/zt03287p262

REPORTS FROM RECIPIENTS OF RESEARCH GRANTS

It is a condition of a research grant that the recipient sends the Society a report of the work done. These are some of the reports.

From **MARIA GULBRANDSEN ASMYHR**, Macquarie University. Exploring the unknown: investigating subterranean biodiversity using molecular tools.

Assessing the biodiversity of the stygofauna hidden in aquifers has its difficulties because of short-range endemism, high levels of cryptic species and lack of formal taxonomic descriptions. The potential of DNA barcoding for rapid biodiversity assessment has been tested. Success was limited using the standard 'universal' and more taxon specific primers for PCR amplification and there were high levels of variability. It will require development of a multiprimer and multigene for DNA barcoding to rapidly assess the biodiversity of the subterranean aquatic ecosystems.

Maria G. Asmyhr and Steven J.B. Cooper (2012). Difficulties barcoding in the dark: the case of crustacean stygofauna from eastern Australia. Invertebrate Systematics 26, 583-591.

From **DR KATHERINE L. BARRY**: Nutritional ecology of mating and sexual cannibalism in Praying Mantids.

Experiments with either a high lipid or high protein diet have shown that females on the high protein diet produce more than twice the number of eggs and attract many more males than those on the high lipid diet. The lipid/protein content of the female body and the eggs are directly related to the dietary intake. There was no significant difference in any other mating behaviour, including cannibalism. The results suggest that diet affects the female pheromone production.

Katherine L. Barry and Shaun M. Wilder (2012). Macronutrient intake affects reproduction of a predatory insect. Oikos, EV1-EV7, 583-589.

From **DEBORAH S. BOWER**: Impacts of salinity on the development of freshwater turtles.

The development of reptilian eggs that incubate in contact with soil and water are reliant on the water quality. Experiments with freshwater turtle eggs subjected to variable salinities have shown that increased salinity inhibits water uptake and the hatchlings are significantly smaller with an increased death rate. The effects of higher salinities on the incubation of the turtle eggs mirror those from turtles incubated in drier media. Increase salinization of the land has the potential is reduce hatching success of reptilian eggs.

Debora S. Bower, Kate M. Hodges and Arthur George (2012). Salinity of incubation media influences embryonic development of a freshwater turtle. Journal of Comparative Physiology B. Published online 02 August 2012.

From **SOPHIA CALLANDER**, Australian National University. Social networks: experimental evidence that courting neighbours affect male attractiveness.

If female mate choice is based on short-term comparison of locally available mates, the attractiveness of the same male might increase when he displays alongside less rather than more attractive competitors. We used robotic models to test whether the number of females that a male fiddler crab, *Uca mjoebergi* attracts depends on the size of his neighbours. Generally, the larger males are more attractive to females and are more likely to win male-to-male fights. Larger males can also influence who their territorial neighbours are because they can assist smaller neighbours to repel intruders. We found that males are more likely to attract females if they court alongside of smaller males, an added benefit of defending his smaller neighbours.

From **BELINDA COOKE**, Macquarie University. Meiofaunal presence in relation to the geomorphology of an exposed sandy beach.

The intertidal zone is densely populated with a great diversity of invertebrates that provide an important food source for surf fishes and shorebirds. Samples were collected along transects to cover all facets of the beach and at two times, mid tide and low tide, and on two consecutive days and two consecutive years.

A total of 18 taxonomic groups were identified: the most dominant groups were Copepods (Harpacticoides), Platyhelminthes (Turbellaria) and Nematoda. Meiofauna decreased in density and diversity up the beach, with distance from the sea. The sandy beach environment is highly dynamic, with environmental change occurring at many time scales due to the influence of tides, temperature, wind and waves. These studies have relevance for beach management and development.

From **ENDYMION COOPER**, University of Sydney. Systematics of the Lepidoziaceae: understanding relationships, biogeography and morphological evolution of this hyper-diverse family of hepatics,

Molecular phylogenetics methods were used to estimate the time of divergence of this family of leafy liverworts. The first divergence of the family is estimated to be in the Early Cretaceous with subsequent establishment of the main lineages within the family in the late Cretaceous with diversification in the Cenozoic. Other families of liverworts gave similar results. The liverworts may be the living relatives of one of the earliest groups of land plants, but much of the extant diversity has evolved in the Cenozoic period.

Endymion Cooper (2013) Notes on early land plants today: 37, towards a stable, informative classification of the Lepidoziaceae (Marchantiophyta). Phytotaxa 97(2), 44-51.

From **ELOISE DEAUX**, Macquarie University. The form and function of dingo vocalisation

An older study had suggested that dingoes had three main classes of vocalisation, whereas other dog species have 10 to 12 basic calls. In this project, dingo behaviour could be grouped into 11 categories, and sound classification resulted in 11 sound categories. ‘Woofs and barks’ appear to serve as warnings and/or threats. ‘Growls and snarls’ are threat signals associated with aggressive and dominance displays. ‘Bark-howls’ are produced when the signaller notices a disturbance in the environment and seems to serve as a warning to other individuals. Howling seems to be associated with identity and it tends to stimulate reply from other individuals. Howls seem to function as group

reinforcers. 'Whines' and 'whimpers' are most often associated with distress, anxiety and nervousness. They were heard most often during social interactions and some are associated with submissive postures. Yelps are associated with submissive displays and as a consequence of receiving pain. Dingoes may also use a mixture of different sounds. Their vocalisations coupled with visual cues suggest a complex communication system.

From **CARLOS DELGARDO-VELEZ**: Bird-parasite interactions along a gradient of urbanisation.

Urbanisation is thought to be stressful for birds and stress levels influence the parasite load. Results have shown that urbanisation effects on parasitism may be site- and species – specific. Some birds adapt to the urban environment and some don't. This study is still in progress.

From **JUDE KEYSE**, Queensland University. Assessment of the genetic connections between marine protected areas in Roviana Lagoon, Solomon Islands.

This project aims to inform the people of Roviana the value of their marine protected areas and how well their conservation strategies are working. Keyse focused on the giant clam, *Tridacna maxima* and *T. crocea* because they are important economically for the aquarium trade. Samples from Roviana Lagoon were supplemented with samples from Marova Lagoon, 100 km away, and these western Solomon Islands populations were compared with the populations in two sites in Papua New Guinea, three sites in the Great Barrier Reef/Coral sea and one in Western Australia. A new species, *Tridacna* sp. was discovered in western Solomon islands.

It was found there is widespread connectivity regionally for *T. maxima* and *T.* sp., with the exception of a deep divide between the east and west coasts of Australia, and this fits well with the pattern of ocean currents. *T. crocea*, however is different, with less connectivity between the populations of the Coral Sea, suggesting that they may rely more on self recruitment.

From **PENELOPE MILLS**, University of Queensland Systematics of the Australian gall-inducing scale insect species group *Apiomorpha minor*.

Field trips to collect the insects have been completed. This study now has 52 females and 10 males from the east coastal strip of NSW and Victoria. The results of DNA analyses are being assessed and material for chromosome study is being prepared. This group has one of the greatest range of chromosome variation known in animals.

From **JAMES O'HANLON**. Macquarie University. The chemical basis of ant attraction and its function as an egg dispersal strategy in Phasmatodes,

In order to disperse their seeds, some tree species have evolved a symbiotic relationship with ants. By providing a food reward attached to their seeds, plants induce ants to pick up their seeds and carry them into their nests where they are safe from predation, desiccation and parasitism. What is more incredible is that certain stick insects lay eggs with a fleshy capitulum attached that works in the same way to induce ants to pick up their eggs and take them into their nests. This structure is unique to stick and leaf insects in the order Phasmatodes.

The phylogeny shows that the capitulum has arisen and been lost many times. Interaction with ants has only been observed in a few species, and these species are distributed globally. Experiments showed that the capitulum could be detached from the egg and attached to a benign object that the ants then took into their nests. However, many species did not elicit a response from ants whether they had a capitulum or not.

Work continues to identify the attractive compounds in the eggs and determine if they are the same or different to those found in the reward attached to seeds.

MICROBES MOVING MOUNTAINS, a talk by A/Prof Mike Manefield.

The Tree of life has been updated. Instead of the old plants, animals and bacteria kingdoms, a small branch of Eucaryotes contains all the plants and animals. Archaea forms a central branch. Archaea look like bacteria but their biochemistry is very different and they are more like us. The third branch, bacteria, is the largest branch of all. Of all the cells in our body, only 10% are eucaryotes and

other 90% are bacterial. Mitochondria are ancient bacteria and are found in all eukaryote cells. They harvest energy by transferring electrons from glucose to carbon dioxide and water. Microbes can do this in a great variety of ways.

Prof Manefield took us on a tour of places where microbes are working for us. The first was St Marys Waste Water Treatment Plant. A series of bioreactors that look like swimming pools receive the waste water, or sewerage and the sludge is activated with a microbial culture. The microbes break down the sludge to carbon dioxide and water.

Microbes are very social and single cells on their own will not do anything. They send out signal molecules and flock together, produce extracellular substances and form a biofilm or slimy layer. When clumped together and the signal molecule is strong enough, they get to work, and in this case, break down the sewerage and purify the water. The water can then be returned to the streams and the spent flocculated material is eventually processed into fertiliser.

The microbes need a little help to get going. Chitin in the form of crab shells that are a waste product of sea food industry are added with the microbial culture. The chitin becomes scratched and pitted and the signal molecule sticks to it and thus ensures successful treatment. Civilization as we know it in the cities depends upon these microbes doing their job.

The next stop was the Biogas Reactor at Camellia near the Rosehill Racecourse. Here, waste food is milled and microbes digest it to produce biogas or methane that then produces electricity. The engineers had worked out the process but they had no idea what was going on. Prof. Manefield was humbled and felt unnecessary.

Archaea work in an anaerobic environment to produce methane and they can harvest their electrons necessary for energy from a wide variety of sources. Different ones can reduce nitrates, iron, sulphur and many more. The electrons flow in an ‘organic circuit board’ and produces ATP that transfers the energy off to where it is needed.

It has been found that synthetic organic phenazine, a histology stain, increases methane production. Crystals of phenazine have microbial cells clustered around them and probably act as a recipient and donor, hence facilitate electron flow. Crystal formation becomes nucleated on organic matter. The microbes transform the food waste into methane.

The third stop was the Botany Industrial Park where organochlorides are a problem. The site, currently used by Orica has been in use for a long time. Chloroform is used industrially and is very useful but disposal is a problem. Organochlorides are very toxic and exposure even in low concentrations over a long time is hazardous. A spill slowly works it way into the ground water and it can take hundreds of years to clear up. Steam cleaning the ground water is very expensive. Activated iron barriers can contain a spill, but they have to be replaced at intervals. Microbes can break down organoclhlorides and do it better. The problem is how to employ them on an industrial scale for bioremediation.

The microbes that will do the job are found in the environment. They are identified and tested to find out which ones will do the job. The selected microbe(s) are then bred up in quantity. Bore water is pumped out into a tank and the microbial culture plus what is necessary to get them working is mixed in with the water that is then pumped back underground. Tests have shown that the water is cleaned up in about two months.

The bioremediation process still requires work. The microbes that clean up organochlorides do not tackle the other pollutants so other microbes have to be found. Hydrology of the ground water is very complicated and movement is very slow. Bores only a hundred meters apart may have water with different pollutants. When the microbial cultures are put back underground, they may stay around that bore and only clean up the water in the immediate vicinity. Although microbes can do the job, how best to use them in bioremediation is yet to be found.

KEYSSTONE EFFECTS OF AUSTRALIA’S TOP PREDATORS: FOCUS ON THE DINGO - a talk given by Dr. Mile Letnic.

All species interact with other species through processes such as competition for food and space, predation and mutualism. A predator has a direct effect on a herbivore and herbivores have a direct effect on the vegetation. Indirectly, the predator has an effect on the vegetation, through the herbivore. A keystone species has strong interactions with other species that are disproportionate to their abundance. So how does the dingo, Australia's largest predator interact with other species in the environment.

The dingo (*Canis lupus dingo*) is descended from a primitive domestic dog that is descended from the Asian wolf. It arrived in Australia about 3,500-5,000 years ago. Prior to its arrival, thylacines and devils were the main predators, and the arrival of the dingo coincided with the extinction of the thylacines on the Australian mainland. The Tasmanian thylacine was larger than the dingo and this presented a dilemma: predators will readily kill other smaller predators but they rarely kill larger predators. However, fossil skulls of the thylacine found on the mainland, especially from caves on the Nullabor showed that mainland thylacines were smaller than their Tasmanian cousins and females were considerable smaller than the males, and hence more vulnerable to attack.

Dingoes will attack livestock and are controlled with 1080 poison, traps and shooting. Exclusion fences attempt to keep dingoes out. Control is necessary or there would not be a sheep industry. Dingoes readily hybridise with domestic dogs, especially in southeastern Australia so that we have difficulty determining what a purebred dingo is like. Museum specimens from the time of first settlement show a wide variation of colours, from light to dark and even brindle (like an Alsation). The dingo is known under other names: native dog, warrigal (the Aboriginal name) and wild dog. When a cull is necessary, the name 'wild dog' is preferred: it somehow does not sound so bad.

Study sites with and without dingo control are compared. Red kangaroos, emus and foxes are more abundant in the absence of dingoes. Rabbits are more abundant in the presence of dingoes. The persistence of small marsupials and native rodents relies on the presence of dingoes that keep fox numbers low. There is a size effect here: large predators (the dingo) eat the large herbivores (kangaroo and emu) and actively seek out and kill the medium sized predators (foxes and cats) that would eat the small mammals. With fewer large herbivores, more grass can grow.

The dingo-proof fence runs from the cliffs on the Nullabor Plain through South Australia to the New South Wales Border and then north before turning easterly, enclosing most of southern Queensland and southeast Australia. Its effectiveness relies on maintenance: holes and washouts along creek lines after heavy rains must be repaired. Work on the dingo-proof fence is a hard and lonely life and fewer are willing to take it up. Nevertheless, a satellite photo of the fence along the SA-NSW border shows a marked difference in the vegetation on either side of the fence. In this area, the hop bush, a native, will take over the area and become a woody weed if left unchecked. Inside the dingo-proof fence, with rare dingoes, lots of foxes and few small mammals, the hop bush proliferates. Outside the dingo-proof fence, with dingoes present, few foxes and more small mammals that eat the hop bush seedlings, the hop bush cover is much reduced.

An experimental area 36 km^2 in area in the arid zone was enclosed in a dingo-proof fence to test if the reintroduction of the dingo would suppress foxes and indirectly benefit small mammals. The experiment is working as hoped. The effects of dingo control in forests were observed in baited and non-baited areas. Areas without baiting had a more diverse and thicker grass and shrub layer, since wallaby numbers were kept in check.

It is tempting to think the reintroduction of dingoes may be the solution to some conservation problems, but it is not a silver bullet. Dingoes induce community-wide changes and there is strong evidence that they can structure ecosystems and have positive ecological effects on taxa of conservation concern. Can we harness the positive ecological effects of dingoes and minimise their impacts on livestock? The farmers with their ingrained antipathy to dingoes will take some convincing.

SECURITY HAS BEEN INCREASED at the Botanic Gardens: there is now a locked gate between the carpark and the Classroom. When you come to a lecture, just

WAIT AND SOMEONE WILL COME AND LET YOU IN.

PROGRAMME

Wednesday 23 October, at 6 pm, in the Classroom, Royal Botanic Gardens. Enter through the gate to the Herbarium Carpark, on Mrs. Macquaries Rd.

Dr PETER WESTON

Senior Principal Research Scientist, National Herbarium of New South Wales

VEGETATION AND FLORA OF SOUTHERN AFRICA

The terrestrial plant communities of southern Africa are often each allocated to one of ten biomes: desert, strandveld, succulent karoo, nama karoo, fynbos, coastal forest, afrotemperate forest, thicket, savanna and grassland. I will illustrate these biomes with photographs of landscapes, plants and some animals, mostly taken on the Foundation and Friends of the Botanic Gardens' tour to Namibia and South Africa, in August-September 2012, on which I was the botanical guide and several Linnean Society members were paying customers. I will focus on environmental attributes of each biome, dominant plant taxa, and species of particular biological and horticultural interest.

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Drinks will be served from 5.30 pm

EVERYONE WELCOMED