



# Newsletter

No. 8

November 2015

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## Insect Conservation in Victoria

*By Dr Tim R. New*

The Eltham Copper Butterfly Festival, held in early November, has become a significant annual community event supported widely by the Shire of Nillumbik and an active 'Friends of the Eltham Copper' group. This year it featured, amongst many other activities, a spectacular dance focused on the butterfly's intricate biology, with groups of children from Eltham East Primary School masquerading as ants, caterpillars, butterflies or volunteers undertaking surveys, to form an enchanting display with wide educational value.



Eltham Copper Butterfly larva (*Paralucia pyrodiscus lucida*) on *Bursaria spinosa* with attendant ant (*Notoncus* species)

The Eltham copper, of course, is perhaps the best-known flagship for insect conservation in Victoria, with the campaign for its conservation in outer eastern Melbourne pursued actively since 1987, when its discovery in Eltham led to it being one of the first invertebrates nominated for listing under the then embryonic Flora and Fauna Guarantee Act 1988 (FFG), not least as a 'test case' to see whether invertebrates were to be 'taken seriously' in that innovative legislation. Active management of the small isolated urban remnant sites has since provided much insight into promoting the practice of insect conservation in Victoria.

Other invertebrates have progressively augmented the small portfolio of taxa deemed significant or threatened and have been important in increasing awareness of the enormous taxonomic and ecological variety present in Victoria, and their roles in sustaining key ecological processes such as pollination – as well as their sensitivity to environmental changes.

The trio of the Eltham copper (with its intricate tripartite association of 'butterfly-host plant-ant, as a terrestrial herbivore), the Hemiphysalis damselfly (an aquatic predator) and the Giant Gippsland earthworm





Eltham Copper Butterfly festival at Edendale Farm  
(see longer article, this issue)

(a subterranean detritivore), all with demonstrable declines but also interest in their practical conservation over recent decades, have been advocated repeatedly to emphasise this variety and the range of ecosystems it affects.

But the few insects and others brought to formal attention by 'listing' are only a tiny tip of a very large iceberg of species that may be declining as human influences spread to expand urban and industrial developments, and arrays of invasive species and other threats diversify.

Unusually, the formal listings under FFG are complemented by a more informal 'Advisory list of threatened invertebrate fauna' that has no legal consequences or obligations but helps perspective by listing those taxa suggested by expert opinion to merit conservation attention through being rare or threatened or, simply, data deficient so that their true vulnerability, although suspected, cannot yet be assessed. As the authors state, the expertise available is very patchy, and coverage is highly incomplete, and much of it outdated: the butterfly entries, for example, are derived from the 2003 National Action Plan, and the most numerous listed beetles (most of them 'data deficient') are the jewel beetles mapped in the 1992 ENTRECS-driven report compiled by Gordon and Joy Burns.

In short, our knowledge of the diversity, conservation status and needs of Victoria's insects is woefully incomplete – but enhanced in large part through interest from the Entomological Society of Victoria, as through

the recent Moths of Victoria series, accumulation of records, and increasing awareness of insect life, and that many taxa may become increasingly vulnerable.

In recent years, the Golden sun-moth has perhaps gained more notoriety than any other native insect, as the centre of disputes over development of periurban grasslands near Melbourne for urban expansion, and with its conservation role enhanced through listing as 'critically endangered' under the Commonwealth Environment Protection and Biodiversity Conservation Act. As for the Eltham copper, community interests are strong and educational influences important, for both species in part through innovative childrens' playgrounds with informative signage. But education and awareness has also been advanced significantly through insect displays at the Melbourne Zoo and Museum Victoria, not least through the breeding campaign for the Lord Howe Island stick insect led by Patrick Honan, whose dedication saved this spectacular species from almost certain extinction.



Lord Howe  
Island Stick  
Insect  
(*Dryococelus  
australis*)

Individual species, with their tangible appeal as conservation targets, are only part of the conservation need, and dealing with each separately is simply impossible. Not least, many insect species are documented from very few specimens, some from single localities, and their resource needs are unknown. Key insect habitats, including wetlands and restricted vegetation types, as well as broader arrays such as native grasslands and urban remnants,

continue to decline as human existence 'progresses'.



European Bumblebee (*Bombus terrestris*)

Direct losses of key resource for native insects are compounded by an enormous array of alien invasive species – such as the European wasp as a generalist predator. A European bumblebee (*Bombus terrestris*) has had considerable harmful impacts in Tasmania, and fears that it could arrive in Victoria are acknowledged through this being listed as a 'Potentially threatening process' under FFG – fears include that it may disrupt long-coevolved intricate pollination associations between native flora and insects. Threats to entire ecological communities commonly involve insects, but the latter have been recognised formally in only few cases. The FFG listing of 'Butterfly Community No 1' founded on the assemblages at Mt Piper, Broadford, has been an important contributor to debate over how such entities may be characterized.

Well-intentioned land management, such as control burning, may pose threats to insects, and remind us that the balances between benefit and threat are often very fine, and highly uncertain.

Conservation of insects is gradually gaining wide acceptance, with recognition of the fundamental ecological importance of 'bugs' and increasing ethical appreciation of values of 'biodiversity' and its most diverse constituents.

However, practical conservation of insects differs in some important aspects of scale from the more familiar treatments of large-bodied and long-lived vertebrate animals. Very small areas, of a hectare or less, may be critical for insects - the Eltham copper populations are a good example – but would be discounted as

'too small' and 'unimportant' in some other contexts.

Linkages between sites in the landscape ('connectivity') for small mobile animals might not always need continuous corridors, but operate through intermediate stepping stone habitats, as attempted for the Swordgrass brown butterfly some years ago by the Knox Environmental Society, who showed also the importance of the urban landscape for insect conservation.

In short, 'insect conservation' has gained recognition and credibility in Victoria, but there is no room for any complacency – the task of assuring our biological heritage for future generations is tantalisingly difficult, and urgent. The Society has much to contribute to this endeavour.

T. R. New  
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### ESV Calendar 2015-16

#### **Saturday 5 December 2015**

Christmas gathering, Westgate Park

#### **Tuesday 19 January 2016**

Council meeting, Melbourne Museum

#### **Tuesday 15 March, 2016**

Council meeting, Melbourne Museum

#### **Tuesday 17 May, 2016**

Council meeting, Melbourne Museum

#### **Tuesday 19 July, 2016**

Council meeting, Melbourne Museum

#### **Tuesday 20 September, 2016**

Council meeting, Melbourne Museum

#### **Tuesday 15 November, 2016**

Council meeting, Melbourne Museum

Further meetings will be announced as they are organised in the next few months. If you have any suggestions for speakers, please contact Patrick Honan at [president@entsocvic.org.au](mailto:president@entsocvic.org.au)



## From the archives

Wings and Stings  
Journal of the Victorian Entomological Society  
Volume 1, No.1  
August 1965

*This is the first page of the first edition of Wings and Stings, the Society's precursor to the Victorian Entomologist. The then President, J.C. le Souef, is now well-known for founding the Society's le Souef Award.*

### The President's Letter

Apart from odd notes in the Victorian Naturalist and other journals and the natural history columns in newspapers and magazines, there has been little entomological information published for many years.

With the ever-increasing urban spread and the clearing of rural lands for cultivation, many areas are now almost devoid of their original insect fauna. If only for the purpose of recording species now found in particular localities before it is too late, the publication of this Journal is important. Apart from this aspect, however, it will provide a medium for setting down even more important information concerning insect life histories and ecology.

While the taxonomist classifies the structural details, confirmation of his thesis frequently requires the eagle eye of the field collector. In this respect observations of even a minor nature can prove decisive in the determination of a species. As we know, the study of entomology is quite the most satisfying hobby, presenting a vast untapped field. It should be remembered that this is one of the few occupations where an absorbing interest can at the same time provide a real public service. I sincerely hope that this Journal will help others to join our ranks.

May I express the Society's appreciation of the work that has gone into the preparation of this publication by the Editorial Committee.

J.C. le Souef

Wings and Stings  
Journal of the Victorian Entomological Society  
Volume 1, No.1  
August 1965

Just as your collections grow by the addition of a specimen collected here and there throughout your travels, so your journal can only be built up by your contributions to its pages.

To those of you who have waited patiently to see your work in print the Editorial staff says "Thank you" for your contributions. To our other readers we say – it is no more difficult than writing a letter. We feel sure you could do as well as those published and you know you can. No matter how small your contribution it will help swell our Journal.

It is not possible for us all to get together and talk of our special entomological interests. It is not possible either for all to be guest speakers; some of us shudder at the thought; but we all read. We all enjoy the other fellow's experiences, the description of the country travelled, what was on the wing or what was found under the logs or stones, in ants' nests or holes in the ground.

Our Journal, it is hoped, will bring us closer together; will help us to enjoy someone else's collecting trip and will broaden our knowledge of the family Arthropoda.

With the Journal's distribution we hope will go a strengthening of our Society; an increase in our membership and above all a greater incentive to attend our meetings and our excursions.

J.C. le Souef

*Editors' note: Although written fifty years ago, the sentiments expressed here still apply today. Your Society survives on your contributions, so please feel free to contribute to field trips, the Victorian Entomologist and the Newsletter at every opportunity.*

## Articles of interest

### **Flying weeds: How the monarch butterfly colonised Australia**

By Ann Jones

Offtrack, Radio National, September 2015

*The monarch butterfly is seemingly embraced by Australians as a part of the ecosystem, but it's actually native to North America and depends on plant hosts from other parts of the world. Ann Jones investigates how this pretty insect came to make its home on Australian shores.*

The arrival of the monarch butterfly in Australia (*Danaus plexippus*) probably occurred with little fanfare. In fact, it's almost impossible to pin down exactly when this pretty brown and black striped butterfly with white spots arrived on our shores.

They are first recorded here in the summer of 1870/71. In a 2004 article in Biological Invasions, Anthony Clarke and Myron Zalucki put forward that there were many almost simultaneous 'first records' around that time, which suggests that the monarch butterfly was already established.

How had such a thing happened? Through an extraordinary stroke of luck, which can only be understood by understanding the butterfly's interwoven relationship with its environment.

The monarch butterflies' host plant, which it relies upon for food and protection in the caterpillar stages, is a milkweed, a group of plants which exudes a milky, latex-like poison when its external skins are penetrated.

'She'll alight, her feet will be touching the surface, her abdomen will arch, will bend under, and she'll put her egg underneath,' says Professor Myron Zalucki of the University of Queensland.

'And she tastes that leaf with her abdomen—her ovipositor has a whole bunch of chemo-sensory hairs that actually sense what's in the leaf surface-waxes of the plant—and make that final decision to lay or not to lay.'

This is a calculated risk by the butterfly mother. The young caterpillar that will emerge from the egg has a certain tolerance of the plant's own defence mechanism, a milky poison that would kill other insects. In fact, the female aims that her offspring will hitch a ride on the back of the plant's defence mechanism to protect themselves in turn.

'So [the plant] has these cardiac glycosides—a whole suite of them,' Zalucki says.

'The caterpillar has dealt with them by excreting them to its exoskeleton, so it essentially stores a lot of these in its own skin, so presumably it tastes bitter.'



Image: Female monarch butterfly (Kenneth Dwain Harrelson. Licensed under CC BY-SA 3.0 via Commons )

Exuding a bitter taste to birds or other potential predators is a strong defence. The predators soon learn not to eat the brightly coloured caterpillars.

But how did such a butterfly get to Australia all the way from North America?

'Monarchs were talk of the town, so to speak, back in the mid-1800s, because the species was about to engulf the entire globe,' Zalucki says.

'They had colonised the Pacific and I think the traffic between California and Australia during the gold rush era of around about the 1840s would have been quite high and probably would have facilitated the colonisation of the islands, and what happened on these islands was quite interesting.'

'Arriving in virgin territory with lots of milkweed, their numbers just exploded. So we have reports of millions of monarchs, milling around. Now they're going to disperse as well, so their chances of getting somewhere nearby are that much higher simply because the numbers are higher. [They] made it to Australia by 1869, 1870, or thereabouts—probably blew in from New Caledonia.'

Movement of small, light, things can happen naturally. Storms and cyclones may be responsible for the movement of the monarch through the Pacific Islands and onto Australia.

But in order to establish a successful breeding population an appropriate host plant, a milkweed, sometimes called cotton bush, would have to be present. There are milkweed species, like the bush banana, in Australia. But the butterfly does not seem to use them. Instead it predominantly uses two species, also imports from other parts of the world—neither of which are from North America.

'In the case of some of the milkweeds that the monarch butterflies use [in Australia]—the *Gomphocarpus* species have come from southern and tropical Africa, and the *Asclepias* species have come from the new world—from the Bahamas and the Caribbean,' says Dr Paul Forster from the Queensland Herbarium.

'We have early records of both of them starting from around 1860 onwards in eastern Australia.

'Of course, in those days there was no quarantine, so a lot of goods came into the country and they probably just came in as contaminants in goods, or perhaps, in the case of *Asclepias*, they had been brought in originally as a garden plant, because they have attractive red and orange flowers.

'They like disturbed soil, and once they arrived, they more or less explosively dispersed right up the eastern seaboard of Australia in the agricultural areas.'

If these plants were not present when the first monarchs flew to ground after the wind storm, or off the ship, then it's entirely possible that



Image: Male Monarch butterfly (Derek Ramsey. Licensed under GFDL 1.2 via Commons)

they would not have successfully established a breeding population. But they found these bitter, poisonous plants on which to lay eggs, and the rest is history—and the present, and probably the future as well. The plants are going quite strongly and populations of the butterflies can be seen in various spots along the eastern seaboard.

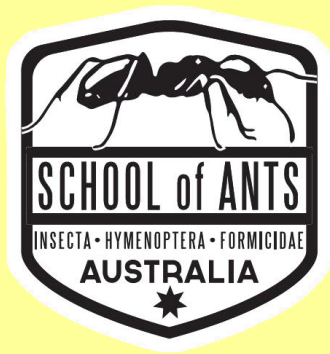
Why is it that this exotic, invasive, non-native, butterfly is seemingly embraced by Australians as a part of the ecosystem? There are hobbyists out there who breed up more monarchs to release. There are companies which will breed monarchs and ship them to you in a pretty container for you to release on your wedding day.

If this was happening with cane toads, this would surely be railed against, so why not with these butterflies? The answer is probably multifaceted, and includes the fact that the monarchs eat a weed rather than a native plant. Zalucki thinks the nectar competition that they provide the native butterflies would be negligible.

'It's very much a perception thing, and we get the same thing with the introduced bumble bee in Tasmania, *Bombus terrestris*. They're so cute and furry and you can't help but like them when you see them. But they are potentially a tremendous pest,' says Dr Dave Britton, the collections manager at the Australian Museum.

'We call the plants weeds in these particular cases, but the reality is that the butterfly is a flying weed,' says Paul Forster.





**Admit it; you have a great ant story just waiting to be told, don't you?**

Here at the School of Ants, we love a good ant story. We'd like to tell stories about ants all over Australia – the rural, regional and metropolitan spaces – and we'd like you to help us.

The School of Ants is an exciting international citizen-scientist driven project in Australia. The original school, and where we got our inspiration, is based in North Carolina in the USA. They aim to document the ants around homes and schools in urban areas, and they've already found out lots about ants in these areas plus rediscovered some species too! The project is also operating in Italy.

We want Australian students, teachers, parents, kids, and junior and senior enthusiasts of all stripes to get involved and uncover a world of ants at our feet, in our homes, schools and parks. Where are the invasive species? Are there some ant species that occur all across Australia? And can you find them?

Ants are ubiquitous in Australia, occupying every habitat and landscape across all States and Territories (excluding Antarctica). Their sensitivity to disturbances of many sorts means they can be used as bioindicators of landscape health, reforestation and mine site recovery. They are important predators, pest controllers and soil engineers, but can also become pests themselves.

Ants also move around with humans all the time, so finding out what ants are where can help us pinpoint problem ants before they cause problems for humans, our environment or agriculture in Australia. The Red Imported

Fire Ant, the Yellow Crazy Ant, Electric Ant and the Argentine Ant are examples of introduced ants that have become problematic. But the project also aims to provide educational outcomes to schools and organisations in Australia.

Here in Australia we're interested in knowing what type of food ants prefer at this time of year in both green and paved areas. There are 3 main steps involved.....

**SAMPLING ANTS** for the School of Ants involves being outdoors!

What a joy to learn outside!

You will put different types of food in green spaces (lawns, gardens, forest) and paved places (asphalt, concrete, cobblestone) for one hour on a warm day. We want to know what ants discover the baits in these green and paved areas. Collecting the samples takes approximately one hour. No prior experience with ants is necessary (but it helps to know which ones sting) – just an interest in participating in science!

**RECORDING DATA** is an important part of any scientific endeavour, so you'll record your data when you are collecting your ants and enter this information into the space provided on the instruction sheet. Make sure you are as accurate and precise as possible about the information you record on these sheets as all data collection must be standardised to be able to be used in our research.

**SUBMITTING YOUR SAMPLES** is easy! After you have completed the ant sampling and completed all your data recording, pop your bagged ants in the freezer and the next day remove the food baits before sending your ziplock bags full of ants and cards AND the data sheets to the identification centre at the address below.

Our Team will identify the ants you send and incorporate your data into maps of backyard biodiversity from this project.

Dr Kirsti Abbott  
c/o School of Ants Australia  
Department of Zoology  
University of New England  
Armidale NSW 2350

## Our Team

### The Scientists

Dr Kirsti Abbott

Kirsti is an ant ecologist and science educator at University of New England in Armidale, NSW. After spending many years looking at tiny insects on tropical islands she now coordinates School of Ants Australia, and in 2015 is travelling around Australia with School of Ants and her family. To get her going on a good rant, ask her about the amount of time primary school kids get outside looking and learning about nature, or the general lack of enthusiasm for bugs these days.....

Associate Professor Nigel Andrew

Associate Professor Nigel is an insect ecologist based in Zoology at the University of New England in Armidale, NSW. He spends much of his time studying how insect biology changes along environmental gradients (latitude, altitude, climatic, agricultural): particularly their ecology, physiology and behaviour. His current research focuses on the impact of climate change on dung beetles, ants and insect-plant interactions. Nigel teaches Entomology and Insect –Plant Interactions at both undergraduate and postgraduate levels and leads a dynamic lab that includes researchers working on interlinked topics insect ecology, physiology and behaviour.

Professor Mark Elgar

Mark is an evolutionary biologist, who teaches evolution and animal behaviour at the University of Melbourne, VIC. He is broadly curious and, as a consequence, his research investigates many different topics about the behaviour and ecology of diverse species, mostly insects and spiders. He has a long-term interest in ants – especially how they organize their lives among themselves and in partnership with other species, and is in awe of the capacity of science to answer questions. Mark is enthusiastic about taking science to the wider community, writing popular articles and co-teaching an open access, online subject on animal behaviour.

Danielle Mills-Waterfield – Illustrator

Danielle is one of our student artists in residence at School of Ants. She graduated in March 2015 with a Bachelor of Zoology from UNE, where she has continued studying Paleobiology, with a strong interest to continue onto postgraduate research into the intellect of urban and nonurban living corvids, including crows. Danielle currently works as an illustrator, commissioned to create both fantastical and realistic avatars and art works, and is keen to work in the illustrated and animated reconstruction of extinct animals, combining her zoological and artistic skills. Martial arts keeps her active and busy in her 'spare' time!

Melissa Jones – Illustrator

Melissa is also an artist in residence with School of Ants.

Dr Sarah Hill – Research assistant & manager  
Sarah is a fire ecologist, having spent years studying the soil seed banks of plant communities. She has a strong love of the Australian bush, which comes from childhood bushwalking and more recently Australian landscape painters.

Sarah currently helps manage the School of Ant project in the lab at UNE, processing ant samples, point mounting specimens and communicating with our dedicated citizen scientists.

Dr. Elizabeth Broese van Groenou

Liz is an ecologist and environmental consultant who started studying ants in pre-Saharan southern Tunisia in 1973. Her research background in the study of harvester ant population energy budgets in western NSW and native plant regeneration processes in the Northern Tablelands have helped develop her interest in the complex interactions between ants and plants.

Over the past 15 years Liz worked as an environmental consultant on a number of biodiversity assessment and vegetation management projects. Liz is currently one of our amazing School of Ants team members working on the curation and identification of ants at UNE.

Steve Trémont

Steve has had a lifelong interest in adventure and zoology, and for most of his adult life he



has worked professionally as a wilderness guide and a fauna consultant, travelling to many remote regions within Australia, Antarctica and Sub-Antarctic islands. These two professions have melded into the most perfect job in the world for him – being outdoors and observing the animal wonders therein. Steve recently changed career direction by starting a PhD at UNE with the Insect Ecology Lab studying the diversity and taxonomy of ants in northeast NSW. He is our resident regional ant expert with the School of Ants team, identifying and curating ants from all over the country.

### The Educators

**Matt McKenzie** – Thalgarrah Environmental Education Centre

Matt is the current principal of Thalgarrah Environmental Education Centre, just outside Armidale NSW. He learnt to love the great outdoors as a youngster as he followed his older brother on many an adventure into the bush. A move to Dubbo gave him an opportunity for virtually his dream job, and a permanent position as the teacher at the Environmental Education Centre in Dubbo. As Principal at Thalgarrah EEC he shares his love for the forest and the river with students from around the New England Tablelands and beyond.

**John McQueen** – Cascade Environmental Centre  
John heads up the Cascade EEC, located just outside Dorrigo, NSW, where students from around the region can experience environmental and sustainable education in a rainforest setting. John always wanted to be Harry Butler and spent lots of time playing in the bush and around his local creek as a kid. He ended up going to university to study science, leisure management and education, which turned out to be a great combination for environmental education! John has been a classroom teacher in Newcastle but now believes he has the best job on earth, sharing nature with children....and he still gets to play at his local creek!

<http://schoolofants.net.au/>

## **Copying nature's tricks to combat harsh environments**

*Robyn Williams  
ABC Radio National Science Show  
October 2015*

When viewed under the electron microscope, some plants and animals show structures which are not visible under the light microscope. These microstructures allow the organisms to adapt to harsh environments and perform amazing feats. The Namib Desert beetle (genus *Stenocara*) stands at 45 degrees to collect water from the air over sand dunes. A cactus has structures which collect dew water from the air. The structures are just the right size to force the water to coalesce into water droplets. Andrew Parker is copying these structures using nanomaterials. The aim is to produce new products which will use the tricks of nature for human benefit. The hope is to take prototypes



to commercial production.

Namid Desert Beetle (*Stenocara* species)

**Robyn Williams:** But where do these bright new ideas come from? Well, try nature itself. Dr Andrew Parker has been doing that for years, both at the Australian Museum in Sydney and now at the Natural History Museum in South Kensington in London. And here are just a few.

**Andrew Parker:** Well, I'm looking at the microstructures, the nanostructures and sub-micron structures that animals and plants have to allow them to be adapted to a range of different environments, from ice caves down to minus 80 degrees in Canada through to deserts at 60 degrees Celcius in Namibia. And it turns out that when you put these animals such as the beetles in Namibia under an electron microscope you start to see minute structures

that you couldn't see under a light microscope. And we start to do calculations on how these microstructures will perform. And you can find that for example they do amazing things to water.

In the case of the Namibian beetles, these are animals that are well known for performing handstands and collecting water on the dunes in Namibia. And you can see from natural history films that droplets of water form out of nowhere almost on their back. But that's actually not the end of the story.

The microstructures that we found allow the animal to capture the fine droplets that are blowing in the wind-laden fog, which are moving really fast in a horizontal direction, and they can actually capture them. What happens is it allows the droplets to coalesce instantly to form a large droplet that's heavy enough to roll back down into the wind and be collected. Otherwise you put a non-stick surface in the way like a frying pan, the fine droplets hit it but blow off in all directions so you can't collect it.

**Robyn Williams:** Yes, what about the surface tension of the water-drop, does that affect the young beetle at all? Because I'd imagine that at that sort of level of smallness it might.

**Andrew Parker:** Absolutely. And these structures, it turned out, are absolutely the perfect size to allow the fine droplets to coalesce and to break that water tension, to be forced, almost, to form a large droplet. If you actually make this, as we discovered when we started making these things, if you make them a little bit larger or a little bit smaller, they just don't work. So evolution has come up with a perfect size to make this happen, which is just fantastic. But equally interesting is now that we can make these things, and we can make them on commercial scale.

**Robyn Williams:** So you're saying that now we are comfortable with nanotechnology you can do dealings at that microscopic or sub-microscopic level.

**Andrew Parker:** Absolutely, yes. But it's only just become possible. We've always had machines that can make prototypes. We can make it on a small scale but we could never

scale it up to take it to commercial levels. But now, it's amazing, we're not only making the prototypes, we're also costing the machines to set up factories to make large quantities of this. As well we're doing some projects for charitable purposes, so these devices can actually collect water in Africa where rainfall is negligible. So we can provide water for at least hospitals to begin with. There's a huge problem, not only having enough water to take medicines and dilute medicines but also to keep the skin clean. There are many millions of people every year dying from not being able to have access to fresh water just for keeping the skin clean.

**Robyn Williams:** Doing it at that nano level nonetheless adds up to sufficient to run a hospital, because they're always washing things as well as using the water for pharmaceutical purposes, so you can actually scale-up?

**Andrew Parker:** That's right. We're finding that we could get a litre of water per square metre of this structure per hour. So that's quite amazing really. So we're scaling up to produce large sheets of this that can be held into fogs and collect the water as runoff.

**Robyn Williams:** That's one impressive example. Give me another one.

**Andrew Parker:** As well with water we're looking at cacti and how they can extract dew water from the air, which they do amazingly well. In fact the cacti that live in deserts that don't rain have exactly the structures to do this, compared to the cacti that live in deserts that do have some rain and can collect water from rainfall. And they are precisely adapted to initiate a droplet of dew on the very tip of their spines, but also to move it along the spine into the plant, so that the tip is free to form another droplet. So you've got this self-replenishing stream of water. So that's another one we're copying, actually in a more elaborate water collecting system at the moment. And so we're just looking for funding now to get that on to a big scale.

But in terms of the micro-structures, what we often find are multifunctional devices. So you might have something that's good at collecting water but it also is good at other things too.

Quite often they are very strong for very lightweight materials, so good for car bodies, for example. But sometimes, as well, they affect light, so they have really good optical

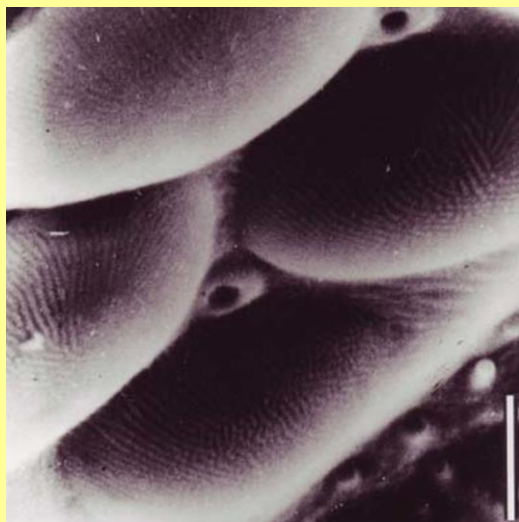


properties.

Flies in amber, 45 million years old, with perfectly preserved eyes. The anti-reflective quality of the flies' eyes has been used to make solar panels capture more energy.

Photo: Andrew Parker/Natural History Museum

There was one case where I found an anti-reflector on the eye of a 45-million-year-old fly. This was a fly in amber, and it had preserved so well that the minute sub-micron structures on its eye surface had preserved. We could make models of that and we tested it with light. Rather than producing any colour or indeed any



Scanning electron micrograph image of a 45 million year old fly's eye, showing four facets, each with the anti-reflector on the surface.

Photo: Natural History Museum

reflections, it did the absolute opposite; it allowed all the light to pass through the surface, which kind of makes sense on the eye of the fly, because this is a fly perhaps...we

think it lived at dawn or dusk where there's very low light levels, so to get all the light through the cornea is a big advantage, so they can actually see during that period. But if you put this now onto a solar panel you get a 10% increase in energy capture because you don't have reflections anymore. So if I could put it on the surface of a glass window, you would no longer see a reflection of yourself. The light just comes straight through without any reflection. So on a solar panel you save all that light that would have been reflected and converted to energy.

**Robyn Williams:** And so what's this made of, how do you get the materials to imitate that?

**Andrew Parker:** So that's a very different subject, and it's one that you suddenly find yourself writing business plans and setting up industries. Here we had to make the structure into plastic, a very thin plastic with a sticky backing that could be self-adhered on to a solar panel. But still we had to make the plastic out of the same refractive index material as the glass. And even the glue had to have the same refractive index, so there was no extra barrier for light to reflect in that system. And now we're trying to make solar panels with this structure embossed directly into the glass surface.

But when I said you can get multifunctional, the other interesting thing that can happen there is that not only can they let light pass through but they can also be super hydrophobic, just like a lotus leaf. So lotus leaves grow for example on the muddy banks of the River Nile but they remain remarkably clean. That's because they have these super-hydrophobic surfaces, these microstructures that cause any water that splashes onto it to ball up, to form really nice spheres. When that happens they roll off the surface rather than run off it. When water runs off, the dirt particles just lift up and then drop back down and stay where they were. But when the water rolls off, it picks up the dirt particles and carries them away, and so self-cleans the surface. So we're trying to combine that property now with the anti-reflective property for solar panels so they can not only gather more energy but also clean themselves.



**Robyn Williams:** Isn't that extraordinary, you've got all these creatures, the remains of creatures, collected millions of them over the years, you'll probably be embarrassed with the wealth of material to investigate, to have other examples of this sort of innovation.

**Andrew Parker:** Absolutely. At the Natural History Museum here we have students trawling through the beetle collection and they are coming up with endless cases of optical devices that people haven't seen before. And actually quite literally in some cases. Some of these beetles produce a really nice iridescent green colour which they use from completely transparent materials they make, so there's no pigment in there at all. These are just optical devices that reflect and refract light to produce a really bright green. And this helps them to camouflage against leaves. But the problem there is that they're also camouflaged against a potential mate. So what they do is they add a polarisation signature into this reflection, so although it looks just green to us, to the beetle it looks a different green to the leaf. The leaf doesn't polarise light, but the beetles have really, really quite sophisticated optical structures in there to cause light to be circularly polarised, so that the animals themselves with polarisation-sensitive vision can actually see this. So until we go around the collections now with polarisers, all these new species are starting to show up.

**Robyn Williams:** I can just imagine a conversation with a minister who says, sceptically, 'Why do you want to collect all these beetles. There's so many beetles, what's the point? I know you like collecting things, but frankly...' And then you say all this stuff.

**Andrew Parker:** Well, that's right. Not only is there the conservation angle and the role they play in the ecosystem, but now they're starting to point the way to new technologies that can improve solar panels. We've got animals that...for example, the fin of a hump backed whale is being modelled to improve wind turbines. I think we're getting a 15% efficiency increase now by copying the scalloped leading edge of a humpbacked whale's fin on to the design of the blades.

But the biggest thing of all actually, and this is what we have been doing with beetles and butterflies, not only are we trying to copy the optical structures in there for new designs and new applications, we want to try and copy the way the beetles and butterflies make them. So we use loads of energy. We have these really high energy systems. We crash molecules into each other and it takes a lot of energy to do that. But nature makes everything at room temperature and pressure. They mix together chemicals and outcome these perfect optical devices with really very little energy at all. Of course they make the maximum use of enzymes and self-assembly.

So what we're trying to do now is to keep the animal cells that make these structures alive in the lab in petri dishes so that we can look at them and observe what's going on in there and measure all the conditions, and see if we can repeat that. So already we're got butterfly scales being made in the lab, these electric blue Morpho butterflies from South America. They're so bright you can see them from an aeroplane flying over the Amazon. And now these scales are just turning up in our lab, being made out of a petri dish. Suddenly there's these blue iridescent flashes coming out. We are some way off just yet, but we think that this is the future really, to copy nature's energy efficient manufacturing process.

**Robyn Williams:** And a final question. If you've got animal industries in here, you mentioned yourself and some students...how are you coping with all the expertise that you require to develop this?

**Andrew Parker:** Well, that's right, we need a bit of help from industry I would say, just at the moment. We are making the most of PhD students and postdoctoral researchers and everything's going great at the moment. But I think to get that next step so that you can get some of these manufacturing processes into industry, we're going to need some big money, some big funding. So we're hoping on a large industry coming in soon.

**Robyn Williams:** Andrew Parker at the Natural History Museum in London.

## University of Queensland research finds spider venom attacks insect pests

*By Daniel Bateman  
The Cairns Post  
September 2015*



VENOM from tarantulas caught within the Far North is used to develop environmentally safe insecticides.

Scientists from the University of Queensland are milking venom from featherleg spiders, also known as the Australian tarantula, caught from an area north of Cairns, to produce a potent chemical to kill insect pests.

The research is to be presented at the Australian Entomological Society Conference in Cairns today.

Dr Maggie Hardy, from UQ's Institute for Molecular Bioscience, helped identify a toxin known as OAIP-1 that is lethal if eaten by termites and cotton bollworm.

She said the toxin had proven to be more potent against certain insect pests than existing chemical insecticides. "It makes sense that spider venoms contain potent insecticides, because spiders are expert insect killers, and have been for about the last 400 million years," she said.

Concerns have been raised about the effect some current pesticides can have upon social insects such as bees, with scientists believing the chemicals could be interfering with the bees' navigation systems.

This can lead to declines in bee populations, which could be disastrous for Australia's agricultural industries.

Dr Hardy said the spider venom had been proven on a molecular level to be safer for bees and other "beneficial" insects, such as ladybugs, which prey on pest species.

It could also be produced on an industrial scale, at an affordable price.

BUG'S LIFE: Live maggots being used in a Deakin University study to examine the benefits of the animals to human medicine. Source: Supplied

"With pesticides, we're trying to move towards a more environmentally sustainable set of controls, and make sure that they don't kill a whole bunch of stuff," Dr Hardy said.

She said although the venom was originally trialled on subterranean termites, there was a broad range of insect pests it could be applied to, including paralysis ticks.

"It could be used in sugar cane, to target the cane borer," she said.

"But the really tricky thing is where the borer lives, which is inside the sugar cane stalk.

"So really, it's a penetration issue."

Featherleg spiders are regarded as one of the largest species of Australian spiders, with their leg spans growing in excess of 16cm.

The burrowing arachnids flourish in dry open forests and deserts.

Dr Hardy said despite the spider's size, they were challenging to milk, using a device to stimulate muscles in the creature's body to encourage it to produce venom. "The venom gland is just a sac, and it's surrounded by muscles," she said.

"And essentially when you apply that slight electrical stimulation to the muscles surrounding the venom gland, it causes the muscles to contract and push the venom out. It doesn't take huge amounts of time.

"But the tricky thing is their fangs are about 1cm long or more and they can rotate nearly 180 degrees backwards.

"So if you don't get them properly, the fangs might get you – but I've never been bitten."

## Stick insects lure ants with fatty knobs

by Yao-Hua Law  
Sciencemag.org  
October 2015



Stick insects are masters of camouflage, fooling predators, prey, and even rivals into thinking they're nothing more than harmless twigs. But according to new research published in the *Journal of Chemical Ecology*, their unborn children may be just as cunning:

Their eggs have "knobs" coated in a special kind of fatty acid that also covers the surface of seeds that are irresistible to ants. The ants drag the eggs to their nests, where they remain protected until they hatch several months later. But just how do the knobs—called capitula— attract ants?

Previously, researchers knew only that some species of stick insects were dropping eggs on the ground in the same way that some trees dropped their seeds—a method of dispersal that relies on ants and other creatures to ferry the seeds to far-flung places. To test what was happening to the stick insect eggs, scientists scattered a batch—half with capitula, half without—from Goliath stick insects (*Eurycnema goliath*) around wild nests of green-headed ants (*Rhytidoponera metallica*). The ants ignored eggs without capitula but collected almost 40% of those covered in the fatty acid knobs. In a further experiment, scientists enticed the ants to retrieve plain plastic balls by gluing capitula on the otherwise inert spheres.

The new research suggests that fatty acids may underlie many interactions between plants and insects, and adds to a growing body of evidence that fatty acids are a key signal in plant and animal communication.

## Preventing Insects from Biting

by Greg Watry  
Research and Design Magazine ([www.rdmag.com](http://www.rdmag.com))  
November 2015

A nonprotein amino acid found in clover, alfalfa and other leguminous plants may provide humans with a second line of defense against bug bites.

"Fruit flies avoid L-canavanine and now we know the identities of the set of receptors that activate a neural pathway that gives a stop-feeding signal," said Univ. of California, Santa Barbara's Craig Montell, a professor of neuroscience and molecular, cellular and developmental biology.

Using fruit flies (*Drosophila melanogaster*), Montell and colleagues discovered three gustatory receptors on the tongue of a fruit fly are responsible for an adverse response to the noxious L-canavanine. A fruit fly's tongue consists of 68 gustatory receptors, which are important for sensing sugars and bitter compounds.

"Our finding that insect GRs collaborate to form a cation channel is of interest because it will set the stage for identifying safe and cheap chemicals that deter insects from biting," said Montell.

The research was published in Nature Communications.

According to the Univ. of California, Santa Barbara, cation channels boast the ability to open and close as a response to chemical or mechanical signals, activating neurons by allowing positively charged molecules, like calcium or sodium. This discovery allows scientists "to conduct high-throughput chemical screens to find equally aversive but safer and less expensive chemicals to use to prevent insects from biting people and spreading disease," according to the university.

Combined with repellants that deter an insect's olfactory attraction to humans, this new development may one day help humans everywhere be less itchy.



## Eltham Copper Butterfly Festival at Edendale Farm

Edendale Farm in the northeast of Melbourne was originally part of a 50 acre farm in the Eltham district, purchased from the Crown in 1852 and eventually sold to the Shire in 1970. The Council established an animal pound and small nursery, which transformed into a Community Environmental Education Centre and indigenous plant nursery in 2000.



The heritage homestead has been beautifully restored and new buildings added in 2011, providing an interactive community and education centre focussing on environmental sustainability.



Edendale Farm offers self-guided activities for schools as well as scheduled lessons in a range of sustainable living programmes. The farm features – extensive gardens which supply an annual crop of fruits and vegetables; goats, sheep, chickens, cows and guinea pigs as well as native animals in indoor enclosures; composting and worm farms.

A main focus of Edendale Farm is the Eltham Copper Butterfly, also a local resident. Edendale

has a strong connection with the Eltham East Primary School which for several years has run programmes on the butterfly collaboratively.



One of the few sizeable events around Australia centred on an insect, the Eltham Copper Butterfly Festival has been held at the farm for the last five years, funded by the Nillumbik Shire Council. The festival includes performances by local school children, as well as activities such as bag making, face painting, cupcake decorating, and butterfly crafts made from recycled materials. Butterfly host plants are sold on the night, sourced from the indigenous nursery, and butterfly gardening is one of the major themes of Edendale activities.



The year's festival was held on Saturday 7 November and was attended by several hundred enthusiastic people, the majority of them families with young children, keen to



spread out the picnic blanket and take in the music and atmosphere.



The Eltham Copper Butterfly (*Paralucia pyrodiscus lucida*) is found only around the suburbs of Eltham and Greensborough, as well as rural areas such as Kiata and Castlemaine. After first being discovered in 1938, the species appeared to go extinct within 20 years but was rediscovered in 1986. The Friends of the Eltham Copper Butterfly and the ECB Management Committee oversee recovery of the species and monitor populations from year to year. State-wide monitoring takes place each October with small groups of volunteers heading out to count the caterpillars climbing Bursaria, their host plant, at night.

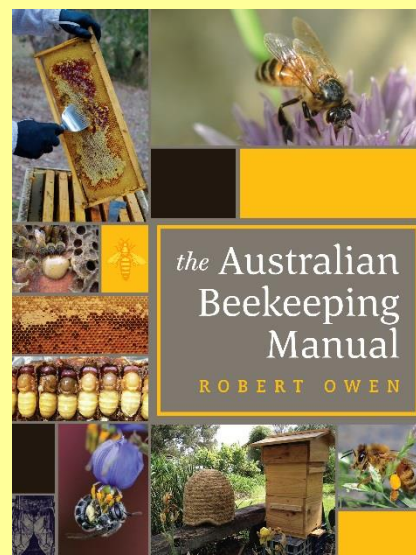


The Friends Group also works hard to improve several reserves known to support the butterflies by weeding, planting and rubbish removal, and has been involved in public education for many years.

An amazing range of activities for a humble Australian insect.

ECB counts – [megan.lowe@banyule.vic.gov.au](mailto:megan.lowe@banyule.vic.gov.au)  
 Friends Group – [waynekinrade@hma.com.au](mailto:waynekinrade@hma.com.au)  
[www.edendale.vic.gov.au/Home](http://www.edendale.vic.gov.au/Home)  
[www.nillumbik.vic.gov.au/Events/Eltham-Copper-Butterfly-Festival](http://www.nillumbik.vic.gov.au/Events/Eltham-Copper-Butterfly-Festival)

## Book launch



Entomological Society of Victoria member Robert Owen's book 'The Australian Beekeeping Manual' will be officially launched on Sunday 29 November 2015.

Where: Edendale Community Environmental Farm  
 30 Gastons Rd  
 Eltham.

Time: 4:30pm to 5:30pm, Macey training room

Further details can be obtained from Robert Owen (03 9439 5410) or:  
 The Eltham Bookshop  
 970 Main Rd  
 Eltham  
 VIC 3095  
 03 9439 8700

The book will be reviewed in an upcoming issue of the ESV Bulletin.

## ESV Council

<i>President</i>	Patrick Honan
<i>Vice President &amp; Excursion Secretary</i>	Peter Carwardine
<i>Hon Secretary</i>	Vacant
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	Maik Fiedel
	Steve Curle
	Ray Besserden



## Excursion to Melbourne Zoo





## Correspondence

### **Nutritional value of Black Soldier Fly pupae (*Hermetia illucens*)**

*From Isabelle Ruhnke, University of New England*

We are planning on a project on the nutritional value of black soldier fly pupae (*Hermetia illucens*) for free range chickens.

Therefore, I am in the urgent need of a live parent stock or 200 kg preserved pupae material before November 2015.

I am very grateful for any contact or suggestion or person experienced with importing insect material!! Please contact me at [iruhnke@une.edu.au](mailto:iruhnke@une.edu.au)  
Best regards,  
Isabelle

Isabelle Ruhnke, Dr med vet, MSc, PhD  
Specialised Veterinarian in Animal Nutrition and Dietetics  
University of New England  
Department of Animal Sciences  
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Fax: +61 2 6773 3922

### **Wild Pollinator Count**

Australia has lots of wild insect pollinators that are often overlooked. European honey bees get a lot of attention because they are an adaptable, generalist forager, which means they are happy to visit almost any flower, in most climate zones. They are also a social species, so their hives are easy to domesticate and manage.

However, many native insects also contribute to pollination in crops and gardens all around the country. We still need to do a lot of research to identify all our insect pollinator species, understand their ecology and how they are affected by human activities. So far, we know

that Australia has around 2,000 native bee species, all of which are important pollinators. We also know there are a couple of thousand butterfly, wasp, fly, moth, beetle, thrips and ant species, some of which are documented pollinators. Unfortunately, we don't have a lot of information on the ecology of many of these insects, what flowers they pollinate, or where they are found.

The Wild Pollinator Count gives you an opportunity to contribute to wild insect pollinator conservation in Australia. We invite you to count wild pollinators in your local environment and help us build a database on wild pollinator activity.

You can **join in** by watching any flowering plant for just ten minutes sometime in our count week.

- You don't need to be an insect expert.
- You don't need fancy gear.
- You may be surprised by what you see!

Find out how to count pollinators, identify the insects you see and submit your observations through the links at the top of the page. You can also download our Run Your Own Count kit and organise to count with a group.

If you have any questions or comments about the count, please email us at [wildpollinatorcount@gmail.com](mailto:wildpollinatorcount@gmail.com).

### **How to Count**

Ever wondered what pollinates your favourite flowers? Take 10 minutes to watch flowers in your garden or local park and take note of what you see! You can print our Wild Pollinator Count Tally Sheet:

[https://wildpollinatorcount.files.wordpress.com/2015/10/wpc\\_tally-sheet\\_2015.pdf](https://wildpollinatorcount.files.wordpress.com/2015/10/wpc_tally-sheet_2015.pdf)

to record your observations, if you wish, and then enter what you've seen into our database: <http://wildpollinatorcount.com/submit-observations/>

If you'd like some help with identifying the insects you see, visit the Resources page: <http://wildpollinatorcount.com/resources/> and What pollinator is that? page: <http://wildpollinatorcount.com/resources/what-pollinator-is-that/>

And if you're not sure what type of pollinator you've seen, you can note that when you submit your observation.

1. During the observation week, choose any day that is sunny, warm and calm. These weather conditions are important, as many insects don't like flying when it's cold, raining or very windy. If there is a shower of rain, wait at least an hour and for the sun to come out before doing your observation. Some pollinators don't fly in strong winds, so make sure it is calm or only lightly breezy when you perform your observation.
2. Find a flowering plant or tree in your garden, or in a local park. Choose a single, large flower, or a group of smaller flowers within your visible range (see Counting FAQ).
3. Watch the flowers continuously for 10 minutes. Record any insect that visits the flowers and moves around on the stamens or pistil (the yellow powdery parts of the flowers). Don't record anything that just flies past without touching the flower. If you can, try not to count the same individual insect twice.
4. Enter your observations on the Submit Observations page. You can record as many different observations as you want – try watching different flowers at different times of the day. If you do multiple observations, make sure to enter each as a separate submission.
5. If you didn't see any pollinators at all, you can still submit your observations as '0' – these observations are just as helpful!
6. We encourage you to try multiple counts in different locations, or on different flowers. Some flowers are more attractive to pollinators than others, so you might see some interesting patterns!

Note: Photos are not necessary to submit an observation, but you can email us some if you choose.

<http://wildpollinatorcount.com/contact-us/>

Thank you for contributing to wild pollinator conservation in Australia!

[www.facebook.com/BeesBusiness](http://www.facebook.com/BeesBusiness)

## *Around the Societies*

### **Butterflies and Other Invertebrates Club**

*Macro Photography Field Day at Mt. Cotton with Erica Siegel*

Learn techniques for capturing the beauty and secret lives and identities of the many insects that call our gardens and bushland home.

**When:** Saturday 30th January 2016

**Where:** Gather at 8am for an 8.30am start, finish at 11.30am, to be followed by refreshments by the creek

**Bring:** Camera and macro lens, lunch or food to share, chair, water bottle – tea making facilities available.

**Wear:** Covered shoes, hat/sunscreen

**RSVP:** Bookings are essential as places are limited. Reply before 23rd January.

**Phone:** Lois on 3206 6229 for bookings and direction to location.

### *Planning and General Meeting*

**What:** Our planning meetings are informative and interesting. As well as planning our activities we share lots of information.

Following the meeting and a lunch break, Russel Denton will lead us through part of the Boondall Wetlands.

We are likely to encounter many invertebrates including lots of butterflies, leaf beetles, ladybird beetles and spiders.

All members are welcome as this activity is also a general meeting of members.

**When:** Saturday 13th February, 2016, 10am

**Where:** Sandgate Town Hall, corner of Cliff and Seymour Streets, Sandgate.

**Bring:** Your own cup as crockery and cutlery are not available at this venue, your lunch, sun protection and probably mosquito repellent!

**RSVP:** Jill Fechner on 0417 793 659 or email [secretary@boic.info](mailto:secretary@boic.info)

### **Entomological Society of Queensland**

#### *An Exhibition of Bancroft memorabilia*

An exhibition entitled "The Doctor, his wife and daughter" will be on display at the Miegunyah

House Museum and will have memorabilia from Thomas L. Bancroft, his wife, Cecillia and daughter, Josephine Mackerras (née Bancroft). Thomas Bancroft was a medical naturalist who investigated mosquito transmission of disease as well as various other scientific investigations.

His daughter, Josephine, was a prominent research entomologist and parasitologist who contributed significantly to malaria research. The memorabilia which will be on display is all from the private family collection. Five generations of the family have been Members of the Queensland Womens' Historical Association.

Miegunyah House Museum is at 35 Jordan Tce, Bowen Hills, Brisbane. Display is open during normal opening hours until Sunday 6th December, 2015. For more information see: <http://www.miegunyah.org>

### **Society for Insect Studies**

From Patrick Tegart – request for assistance  
Bioblitz event at Wallagoot Lake  
4-5 December 2015

My name is Patrick and I am one of the organisers helping to develop the survey/activity plan for an upcoming Bio-Blitz on the south coast of NSW. One aspect of previous BioBlitzes we have organised in the region that we feel has been missing is invertebrate based survey. On behalf of the BioBlitz management team I would like to invite you to come to the event which will be held on the 4/5th of December to lead surveys and help improve community knowledge.

### **Background**

During the past three years the Atlas of Life in the Coastal Wilderness has organised three successful BioBlitzes in the south coast region:

- Bermagui over 700 species recorded
- Panboola over 600 species recorded
- Mimosa Rocks over 1000 species recorded

During this time ALCW has demonstrated the value of BioBlitzes as mechanisms to engage a broad range of the community and scientists in intensive scientific surveys. The outcomes are: significant species lists for the chosen location,

significant enjoyment and learning for the participants, continued willingness of the scientists and natural-ists to contribute to this activity and a strong network of engaged organisations and individuals.

This year we will be planning a BioBlitz within the Wallagoot Catchment. The catchment is predominately forest or woodland with cleared land for agriculture. Wallagoot Lake itself is an ICOLL - with high vulnerability as it has the lowest opening frequency on the South coast. It has seagrass beds and small areas of saltmarsh). There are large areas protected in the Bournda National Park and Bournda Nature Reserve as well as Bega Local Aboriginal Land Council land and property in private ownership.

For more information about the project feel free to contact me by phone 0449162594 or my email [pd.tegart@gmail.com](mailto:pd.tegart@gmail.com)

## *Conferences*

### **XXV International Congress of Entomology**

**Where:** Orlando, Florida, USA

**When:** 25-30 September, 2016

### **Entomology without Borders**

Over 300 symposia were submitted from around the world to be considered for the ICE 2016 program, and they are currently being reviewed by the ICE Section Co-conveners. Watch for announcements of final symposia selections to be made next month.

### **Society of Australian Systematic Biologists**

Invertebrate Biodiversity and Conservation Conference.

New Generation-Next Generation

**When:** 6-9 December 2015

**Where:** The Esplanade Hotel, Fremantle

**Website:** <http://www.sasb2015.org>

### **Joint meeting of the Society of Australian Systematic Biologists (SASB) and Invertebrate Biodiversity and Conservation Conference (IBCC)**

**When:** December 6–9, 2015

**Where:** Fremantle, Western Australia

**Website:** <http://sasb2015.org/>

Contributions to the ESV Newsletter and Bulletin are always welcome. Contact: Patrick Honan [president@entsocvic.org.au](mailto:president@entsocvic.org.au)