
The Entomological Society
of New Zealand
71st
Entomological Society
of New Zealand
Conference
Tāmaki Makaurau
30 Aug - 1 Sep
2023
Biosecurity New Zealand
Ministry for Primary Industries
Manatū Ahu Matua
scion
FORESTS • PRODUCTS • INNOVATION
THE UNIVERSITY OF
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Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND
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Contents

Haere mai - Welcome

Kia ora!

We welcome you to the 71st annual conference of the Entomological Society of New Zealand, at the Ellerslie Events Centre in Tamaki Makaurau - Auckland. We have an exciting programme planned. There is plenty of time allocated for breaks, lunches and evening activities. Please engage to the fullest and make the most of what is always an inclusive, stimulating and collegial conference.

We look forward to meeting each of you!

On behalf of the Conference Committee and the Society Executive.

Sponsors

We would like to recognise and thank our generous sponsors supporting our conference this year.

Biosecurity New Zealand through their Plant Health and Environment Laboratory is sponsoring our Biosecurity session; SCION is sponsoring our Taxonomy and Systematics session and The University of Auckland is sponsoring our poster session. We are most grateful.

Information for delegates

Venue

The conference will be at the Ellerslie Events Centre, Guineas Ballroom in the Ellerslie Stand (ES). This is on the top floor Level 3 of the Events Centre building and is accessible by elevator and stairs. See location in the Map section at the end of this programme Free car parking is available on site for delegates of the conference in car park A (outside gate 6), and car park D inside gate 6.

NB: The speed limit inside the grounds is 10 km/hr. Getting there: Address 100 Ascot Avenue, Remuera, Auckland 1050.
Ellerslie Event Centre is within the grounds of Ellerslie Racecourse and is easily accessible by car, bus or train. Vehicle entrance is via Gate 3. See Map at end of the programme.

Oral presentations

Full talks are 15 minute slots (12 mins + 2 min question time + 1 min transition)
Speed talks are 5 minute slots (3 mins + 1 min question time + 1 min transition)

Please rehearse your presentation to ensure it stays within the allocated time. Presentation instructions can be found on the ESNZ conference webpage.

Please note you will not be able to present from your own computer. Instead, presentations will be uploaded to the conference laptop. Talks will be presented on a Windows 10 laptop with Powerpoint installed.
Your PowerPoint presentation can be uploaded via the conference webpage until 29th August. If you do not submit your presentation online, please load it directly onto the conference laptop well before your session.

Posters

Please place your posters on the poster boards provided in the Guineas Ballroom during registration **(Wednesday morning)**. Thank you!

Posters should preferably be printed A0 or A1 in size, and mounted on the poster boards on the first morning of the conference. Posters should stimulate discussion, not give a long presentation. Therefore, keep text to a minimum, emphasize graphics, and make sure every item included in your poster is necessary. Here is an excellent resource on poster design – The-best-poster-ever-made interview.

Events

Pre-conference Tuesday 29th August

New Zealand Arthropod Collection (NZAC) - Ko te Aitanga Pepeke o Aotearoa
OPEN TO CONFERENCE VISITORS 9:00am - 4:00pm
If you would like to visit please contact: Grace Hall. Email: hallgr@landcareresearch.co.nz or call 027 226 0428.

Poster Session Wednesday 30th August

(Sponsored by The University of Auckland)
16:30 - 17:30 hrs. Nibbles and drinks available at the bar.

Conference Dinner 7:00pm Thursday 31st August

Our dinner will be held at **Sorrento in the Park**, which sits inside Maungakiekie / One Tree Hill Domain. It is approx. 3.8 km from Ellerslie Events Centre. A 15-20 min drive, traffic dependent (or a ~45 min walk). Buses have been arranged to take you there and back.

The dinner venue address is 670 Manukau Road Royal Oak, Auckland, 1023, New Zealand.

Dinner Transport

Two buses will depart the Events Centre Carpark A (outside gate 6). We encourage you to take the bus. [**Note:** delegate's cars can be left in Carpark A and picked up on return.]

Buses depart at 6:30pm to the dinner venue, returning 10:00pm to Events Centre Carpark A.

Merchandise at the Venue

We're pleased to host a small selection of entomology related merchandiser stalls, as well as showcase some of our members' artistic talent.

Come prepared, make sure you bring some cash, and a mobile banking app on your phone. All sales are made directly with the merchandiser/artist.

Entomological Society of NZ
We will have a small range of conference merchandise available for you to show your support!

The Members Merch Table
Entomology related art produced by our society members. Items are displayed with the artist name and any price/purchase options if applicable.

Mad Hornet Entomological Supplies
madhornet.co.nz
Pins, minutens, soft tweezers, catching nets, cages, magnifiers and more, now locally obtainable in New Zealand.

Steph & Paddy Prints
stephpaddyprints.co.nz
Nature-inspired designs and gifts including t-shirts, wine glasses, mugs, cushions, bunting, badges and more.

Moth and Butterflies Trust of NZ
nzbutterflies.org.nz
Promoting a thriving moth and butterfly population.

Manaaki Whenua Press
landcareresearch.co.nz
Some older issues of the *Fauna of New Zealand* will be available.

Eat Crawlers
eatcrawlers.co.nz
Insect-based food products that are both exciting and sustainable for eaters.
Open a limited time, Wednesday 30th, Afternoon Tea until Poster Session

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Pubs, Restaurants and Coffee

Coffee: Note there is a charity coffee stall opposite the Novotel hotel by the gate to the train, with proceeds going to assisting the needy with medical care.

Pubs: Ellerslie township is about a 1.2 km (~ a 15 min walk) South East from the Events Centre. There you will find a number of pubs and restaurants. See Map section below.

Doolan Brothers Irish Pub: 3 Robert Street, Ellerslie, Auckland 1051

Union Post: 124 Main Highway, Ellerslie, Auckland 1051

Restaurants: Novotel Ellerslie - Acacia, a restaurant that features a bar/lounge.

Transport

Train: Greenlane station is a short (10 min) walk from the venue (see Map A below), you can catch a train here to the city centre. If you're staying in the city, or Newmarket, why not beat the famous Auckland traffic and catch a train to the conference.

Taxis: Ph: 09 300 3000 Combined taxis.

Thank you!

Special thanks to those that assisted in planning, and to you for attending!

Conference Organising Committee: Dave Seldon (chair), Aaron Harmer, Alan Flynn, Cassie Mark, Chris Green, Eloise Lancaster, Grace Hall, Ian Boothroyd, Joanna Mackisack, Olwyn Green, Rich Leschen, Sherly George.

Merchandise coordinator: Joanna Mackisack.

NZAC Tour Coordinator: Grace Hall.

Catering: Ellerslie Events Centre

Conference Art: Aaron Harmer, Asia King, Molly Flynn.

Schedule Overview

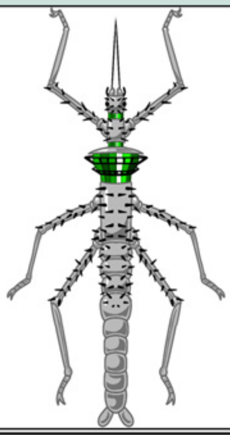
Tuesday 29 Aug

Pre-Conference Activity

New Zealand Arthropod Collection (NZAC) - Ko te Aitanga Pepeke o Aotearoa

OPEN TO CONFERENCE VISITORS
9:00am - 4:00pm

If you would like to visit please contact
Grace Hall
E-mail:
hallgr@landcareresearch.co.nz
027 226 0428



Wednesday 30 Aug

	Wednesday 30 Aug
8:30	**Registration Opens** Coffee and Tea Available Posters can be hung on poster board
9:30	**Welcome** - Mihi Whakatau- from Te Kahurati - Reply from President -Tara Welcome from Conf Commitee/Houskeeping - Dave
10:00	**Morning tea**
10:30	**1. Plenary & General**
Chair	*Chrissie Painting*
10:30	**Plenary: David Pattemore** Valuing and supporting the contribution of insects to productive ecosystems
11:15	**General**
11:15	Alan Flynn
11:30	Tara Murray Speed talk
11:40	Conference Photo
12:00	**Lunch**
13:00	2. **Biosecurity** **Sponsor: MPI Bioseccurity NZ**
Chair	*Steve Pawson*
13:00	Ben Boyd
13:15	Carolin Weser *
13:30	Eloise Lancaster
13:45	Jessica Kerr
14:00	Joanna Mackisack
14:15	Joanne Poulton
14:30	Murray Fea
14:45	Samuel Brown
15:00	**Afternoon Tea**
15:30	**3. Conservation**
Chair	*Samuel Brown*
15:30	Eric Edwards
15:45	Ian Boothroyd
16:00	Tara Murray
16:15	*Short break for those presenting posters*
16:30	**Poster Session** **Sponsor University of Auckland** *(Bar Open- Food platters - one complimentary beverage per person)*
17:30	**End of day 1**

Notes: * Indicates Student Talk

Thursday 31 Aug

	Thursday 31 Aug
8:30	**Day Registration Opens** Coffee and Tea Available
9:00	**Day welcome - notices**
	4. Plenary
Chair	*Cor Vink*
9:15	**Plenary: Ximena Nelson** Cognition in jumping spiders – seeing is thinking
10:00	**Morning Tea**
10:30	**5. Physiology & Behaviour**
Chair	*Jenny Jandt*
10:30	Ashley Mortensen
10:45	Hamish Doogan*
11:00	James Roberts*
11:15	Kelly Greig *
11:30	Luke Thompson*
11:45	Luna Thomas*
12:00	**Lunch**
13:00	**6. Physiology & Behaviour**
Chair	*Sheri Johnson*
13:00	Mateus Detoni
13:15	Richard Leschen
13:30	Simon Connolly*
13:45	Zhuali Lim*
14:00	Fabio Weiss*
14:15	Bridgette Farnworth
14:25	*Head back inside*
14:30	**General Business** members discussion **Chair: Tara Murray**
15:00	**Afternoon Tea**
15:30	**7. Ecology**
Chair	*Eric Edwards*
15:30	Mary Angelique Tavera*
15:45	Maryanne Walker*
16:00	Nimali Suwandharathne*
16:15	Nyasha Chikwature*
16:30	Samantha van Ryn*
	Genes & Genomes
16:45	Graham McCulloch
17:00	Nathaly Lara Castellanos Speed talk
17:05	Sheri Johnson Speed talk
17:10	Ayad Masry
17:25	**End of day 2**
18:30	Buses(x 2) to Dinner Pick up from Events Centre Carpark A (outside gate 6) *some delegate cars left in Carpark A*
19:00	**Dinner - Sorento in the Park**
22:00	Buses (x2)Depart Returns to Ellerslie Events Centre Carpark A (outside gate 6)

Friday 1 Sept

	Friday 1 Sept
8:30	**Day Registration Opens** Coffee and Tea Available
8:45	**Day welcome - notices**
	8. Plenary
Chair	*Rich Leschen*
9:00	**Plenary: Nicholas Porch** How extensive are late Holocene insect extinctions on Indo-Pacific oceanic islands?
9:45	**Taxonomy & Systematics** Kyle Whorrall *
10:00	**Morning Tea**
10:30	**9. Taxonomy & Systematics** **Sponsor - Scion**
Chair	*Morgane Merien*
10:30	Cor Vink
10:45	Danilo Hegg
11:00	Ian Boothroyd
11:15	Julia Kasper
11:30	Olivier Ball
11:45	Robert Hoare
12:00	**Lunch**
13:00	**10. Curation & Collection Care**
Chair	*Julia Kasper*
13:00	Aaron Harmer
13:15	Johno Ridden
13:30	Leanne Elder
13:45	Morgane Merien
14:00	Rebecca Le Grice
14:15	Discussion time for Curation session. 1hr
15:15	**11. Awards & Closing Ceremony**
Chair	*Tara Murray & Johno Ridden*
15:30	**Afternoon Tea**
16:00	**Conference closes**
	End of day 3
	Organisers Pack down and clean up
17:00	**Vacate Venue**

Notes:

Entomological Society of New Zealand

71st Conference

Ellerslie Events Centre, Tamaki Makaurau / Auckland

30 August – 01 September 2023

Detailed Schedule of Events

Wednesday 30 August 2023			
	8:30	Registration Opens Coffee and Tea Available	* Indicates Student Talk
	9:30	Welcome Conference Opening	
	10:00	Morning tea	
Session Chair		Chrissie Painting	
Plenary	10:30	David Pattemore	Valuing and supporting the contribution of insects to productive ecosystems
General	11:15	Alan Flynn	Silk moth tales: Historic records of Exotic saturniids and their link to the 1980s 'Republic of Pakuranga', Auckland.
	11:30	Tara Murray	Speed talk The New Zealand Threat Classification System needs you!
	11:40	CONFERENCE PHOTO - Outside	
	12:00	Lunch	
Session Chair		Steve Pawson	
Biosecurity	13:00	Ben Boyd	Fall armyworm in New Zealand
Biosecurity New Zealand Ministry for Primary Industries Manatū Ahu Matua	13:15	Carolin Weser*	Identifying predators of eucalypt-defoliating paropsine leaf beetles in Marlborough
	13:30	Eloise Lancaster	A look at New Zealand ant fauna in high-risk invasion sites
	13:45	Jessica Kerr	Portable electroantennograms – working towards a field-based tool for applied chemical ecology
	14:00	Joanna Mackisack	"What's this bug?" An analysis of five years of suspect pest insect notifications
	14:15	Joanne Poulton	Assessing the risk of *Xylella fastidiosa* : Could native spittlebugs play a role in spreading the pathogen in New Zealand?
	14:30	Murray Fea	Department of Conservation Biosecurity Research Priorities
	14:45	Samuel Brown	Testing the Toolbox—evaluating methods for predicting the risk posed by biological control programmes
	15:00	Afternoon Tea	
Session Chair		Samuel Brown	
Conservation	15:30	Eric Edwards	*Kiwaia* 'Cloudy Bay' (Lepidoptera: Gelechiidae), the mat daisy jumper moth: recording its last jump…?
	15:45	Ian Boothroyd	Directing connectivity in the landscape for the maintenance of indigenous biodiversity
	16:00	Tara Murray	Testing outcome monitoring methods to measure invertebrate responses to landscape-level pest control
	16:15	*Short break for those presenting posters to get ready*	
Poster Session	16:30	*Poster Presentations & Drinks Session* ***Sponsored by the University of Auckland***	
End of Day 1	17:30	End of Day 1	

Thursday 31 August 2023

	8:30	Day Registration Opens Coffee and Tea Available	* Indicates Student Talk
	9:00	Day Welcome - Notices	
Session Chair		*Cor Vink*	
Plenary	9:15	Ximena Nelson	Cognition in jumping spiders – seeing is thinking
	10:00	Morning tea	
Session Chair		*Jenny Jandt*	
Physiology & Behaviour	10:30	Ashley Mortensen	Beekeeping outside the box: innovative colony handling and hive architecture
	10:45	Hamish Doogan*	Are there differences in behaviour between the two colour morphs of the mountain stone wētā, *Hemideina maori* ?
	11:00	James Roberts*	Comparing dispersal potential between the threatened endemic katipō spider (*Latrodectus katipo*) and the invasive false katipō spider (*Steatoda capensis*) through behavioural assays.
	11:15	Kelly Greig*	Non-visual camouflage in Zopheridae beetles
	11:30	Luke Thompson*	Investigating differences in behaviour between predator naïve and predator aware mountain stone wētā, *Hemideina maori*
	11:45	Luna Thomas*	Who wins in competitive interactions between males of the iconic New Zealand stag beetle, *Geodorcus helmsi* ?
	12:00	Lunch	
Session Chair		*Sheri Johnson*	
Physiology & Behaviour	13:00	Mateus Detoni	The effect of nectar-borne microbes on the foraging behaviour and diet of European honeybees (*Apis mellifera*)
	13:15	Richard Leschen	Snapshots of Aleocharine Rove Beetles *(Staphylinidae*)
	13:30	Simon Connolly*	Introgression in New Zealand Fishing Spiders (*Dolomedes*)
	13:45	Zhuali Lim*	Foraging and nesting behaviours of ground-nesting bees in Dunedin
	14:00	Fabio Weiss*	Unprecedented drought in Europe triggers declines in carabid beetles in a German forest area
	14:15	Bridgette Farnworth	Are big jaws a big problem for New Zealand's ugliest bug?
	14:30	General Business members discussion *Chair: Tara Murray*	
	15:00	Afternoon Tea	
Session Chair		*Eric Edwards*	
Ecology	15:30	Mary Angelique Tavera*	Chemical Profile Analysis of New Zealand Native Bees, 'Ngaro huruhuru'
	15:45	Maryanne Walker*	Developing a method of molecular analysis of scats for estimating diet of the European hedgehog (*Erinaceus europaeus*).
	16:00	Nimali Suwandharathne*	A temperature-based phenology model for *Tamarixia triozae* , a parasitoid of *Bactericera cockerelli*
	16:15	Nyasha Chikwature*	Evaluating ecologically sustainable ways to disrupt the ground wētā -vine association.
	16:30	Samantha Van Ryn*	A thorn amidst the roses: Improving invertebrate diversity in rose gardens
Genes & Genomes	16:45	Graham McCulloch	Isolation by rock stack? Genomics reveals metapopulation dynamics of alpine wētā
	17:00	Nathaly Lara Castellanos	Speed talk Utilization of mitochondrial genes for species identification of Bactrocera fruit flies (Diptera: Tephritidae) from the Pacific Islands
	17:05	Sheri Johnson	Speed talk Population genomics of an iconic stag beetle
Ecology	17:10	Ayad Masry	Detection and monitoring fruit fly pests (Diptera: Tephritidae) using traditional insect traps in northeast Libya.
End of Day 2	17:30	End of Day 2	
	18:30	Buses(x 2) to Dinner Pick up from Events Centre Carpark A (outside gate 6) Delegate cars can be left in Carpark A	
Dinner	19:00	Dinner - Sorento in the Park	
	22:00	Buses (x2)Depart Returns to Ellerslie Events Centre Carpark A (outside gate 6)	

Friday 1 September 2023

	8:30	Day Registration Opens Coffee and Tea Available		* Indicates Student Talk
	8:45	Day Welcome - Notices		
Session Chair		*Rich Leschen*		
Plenary	9:00	Nicholas Porch	How extensive are late Holocene insect extinctions on Indo-Pacific oceanic islands?"	
Taxonomy & Systematics	9:45	Kyle Whorrall*	Morphological character use in the diagnosis and taxonomy of New Zealand zopherid beetles (Coleoptera: Zopheridae)	
	10:00	Morning tea		
Session Chair		*Morgane Merien*		
Taxonomy & Systematics	10:30	Cor Vink	An attempt to reunite the pacific bounty hunter, *Pacificana cockayni* Hogg, 1904, with its family	
	10:45	Danilo Hegg	A long time coming: a taxonomic revision of the genus *Isoplectron* Hutton, 1896 (Orthoptera: Rhaphidophoridae)	
	11:00	Ian Boothroyd	From the mountain to the sea: a checklist of the diversity and habitats of the chironomid midges	
	11:15	Julia Kasper	Population dynamics of glow-worms *Arachnocampa luminosa*	
	11:30	Olivier Ball	Latest updates on New Zealand's landhopper fauna (Amphipoda: Talitroidea)	
	11:45	Robert Hoare	Alfred Philpott and the Phantasmagorical Fungivores	
	12:00	Lunch		
Session Chair		*Julia Kasper*		
Curation and collection care	13:00	Aaron Harmer	New tools for rapid imaging and digitisation of pinned insects	
	13:15	Johno Ridden	On the move: relocating the Canterbury Museum spirit collection.	
	13:30	Leanne Elder	Planning and strategy for accelerating digitisation of the New Zealand Arthropod Collection	
	13:45	Morgane Merien	Tracing the journey of Canterbury's Wallace beetles	
	14:00	Rebecca Le Grice	On the move: relocating the Canterbury Museum pinned insect collection	
Curation Discussion	14:15	Discussion time for Curation session		
Session Chair		*Tara Murray & Johno Ridden*		
	15:15	Awards & Closing Ceremony		
	15:00	Afternoon Tea		
	16:00	Conference closes		

Poster list

General	Darshika Dissawa	Effects of Chlorothalonil on *Drosophila melanogaster* survival and fecundity
	Sophie Hunt	Acoustic trapping for cricket control
	Stephanie Sopow	Spread of *Pauesia nigrovaria* , biological control agent for giant willow aphid
Biosecurity	Barbara Lima	Egg parasitoids survey of stink bugs in New Zealand – could resident egg parasitoids help against BMSB?
	Ben Wynne-Jones	Entomology Diagnostics for High-Risk Site Surveillance 2022-2023
	Frances MacDonald	What is on my native/taonga plant? Is it fall armyworm?
	Jessica Kerr	Exploring the nature of *Arhopalus ferus* (Coleoptera: Cerambycidae, Spondylidinae) pheromone attraction
Ecology	Jennifer Jandt	Pollinator performance and cognition in semi-natural simple or complex floral environments
	Pei Man*	How do invertebrate communities respond to native forest restoration in human-modified landscapes?
	Stephanie Godfrey	Seasonal patterns of emergence in the stick insect *Niveaphasma annulata*
Taxonomy & Systematics	Hamaseh Aliakbarpour	Record of *Thrips hawaiiensis* (Thysanoptera: Thripidae) in New Zealand
Curation and collection	Phil Sirvid	Why voucher specimens matter

Plenaries in order of Schedule

Wednesday 30th August

Dr David Pattemore
Plant & Food Research

Valuing and supporting the contribution of insects to productive ecosystems

David leads the Productivity Biodiversity & Pollination group at Plant & Food Research, which is comprised of three science teams that work on a broad spectrum of research from floral biology, pollination ecology and pollinator biology, to apiculture and bee health, and further on to natural enemies and broader beneficial biodiversity on farms and orchards. The team works closely with industry and community partners in New Zealand and Australia, as well as projects further afield. David's specific background is in ecology, with a PhD from Princeton University in the US, where he got into pollination biology as a way to measure the contribution of species and communities to ecosystems. David also has a part-time appointment at the School of Biological Sciences at the University of Auckland (where he also directs the Joint Graduate School in Plant & Food Science), with students in his lab working on projects ranging from moths as pollinators of crops, the impact of pesticides on native bees, and factors affecting bat presence and activity in productive and developed landscapes.

Abstract
Insects make a significant contribution to the productivity of crop systems through diverse roles including pollinators, predators, and decomposers. While pollination by honey bees is recognised by the public as an important service, less well known is the vast diversity of insects that play a role in pollinating the world's crops, let alone the myriad of other insects that contribute directly or indirectly to crop production in other ways. I'll share the experience of our pollination team at Plant & Food Research, where we worked first to quantify and promote the role of diverse pollinators, and how this has led us to look beyond pollination to the other key ecosystem services provided by insects in orchards, and how managing the orchard environment (including native plantings), can support populations of beneficial insects.

Professor Ximena Nelson
University of Canterbury

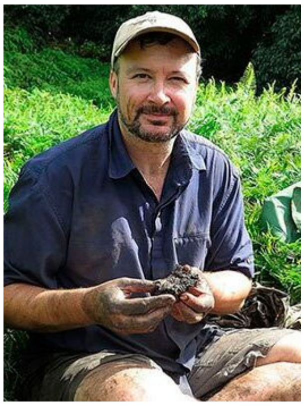
Cognition in jumping spiders – seeing is thinking

Born in Mexico of kiwi parents, and raised in Chile, Ximena Nelson is now Professor of animal behavior at the University of Canterbury, where she primarily focuses on the visually-based behaviour of jumping spiders (Salticidae). Her work has involved extensive research on ant mimicry by salticids, how salticids discriminate between different prey types (based on both chemical and visual cues), attention, and courtship behaviour. More recently, she has begun examining how risk assessment may provide insight into salticid planning and other aspects of their decision-making. A major theme underlying most of these topics is a keen interest in the salticid visual system and the limits of their visual ability, both in a cognitive sense and in a physiological sense.

Abstract
I will present an overview of my work on cognition in jumping spiders, arguing that these animals are excellent models for studies on cognition due to their visual, active, and predatory lifestyle. Due to their need to leave a nest to explore their complex surroundings for food and mates, which are detected and classified visually at a distance, these animals exhibit not only navigational prowess, but also spatial ability that seems to include forward-planning in their decision-making. The sophistication of their behaviour is similar to that seen in some mammals, yet they have a fraction of the ‘brain power’. It is for this reason that jumping spiders allow us to explore, in depth, hypotheses pertaining to the evolution of cognition, and the trade-offs between speed (Kahneman’s ‘thinking fast’) and accuracy (Kahneman’s ‘thinking slow’) that animals make when making decisions. I will attempt to persuade the audience that social or habitat-based hypotheses thought to drive selection for advanced cognition may be no less important than the ability to accurately detect objects from a distance, and that vision is unique in this respect.

Dr Nick Porch
Deakin University

How extensive are late Holocene insect extinctions on Indo-Pacific oceanic islands?



Nick Porch is a palaeoecologist and invertebrate biologist in the School of Life and Environmental Sciences at Deakin University in Melbourne. His research interests include understanding how humans impact biodiversity, and the systematics, ecology and biogeography of Australian terrestrial invertebrates. He has unique experience in the palaeoecology of insect assemblages, especially the exploration of the consequences of human arrival on island biota, ranging from the Mascarenes in the Indian Ocean, to Polynesia, and beyond. He is especially interested in how discovery of extinct insect assemblages alters understanding of oceanic island biogeography and ecology, how people translocate insects and their ecosystem impacts, and how we can use palaeoecology to better inform the conservation of island biotas.

Abstract
There is little doubt that the human colonisation of remote oceanic islands has resulted in the extinction of a large number of species, some directly hunted for food, and others as a consequence of the transformation of island ecologies. Most evidence comes from vertebrate palaeontology, supplemented by data on land snails and occasionally other taxa like plants. Indeed, land snails are among the most impacted taxa, suggesting that indirect environmental pressures resulting from human colonisation are as important, or more important, than direct human predation. If this is the case, then what happened to the insect faunas which shared the leaf litter, rotting logs, water ways, and vegetation of these remote island ecosystems? In this talk I will introduce research exploring this issue with examples from the Mascarenes (Indian Ocean) and Polynesian region. Prehuman insect faunas from swamps and sinkholes include a wide range of taxa that are regionally extinct, or restricted to much higher altitudes today, where these are present on high islands. The extent of these likely extinctions means that there are potentially thousands of extinct species of insects across the Indo-Pacific, most of them lost over the last 200-1000 years. What caused these extinctions? Are they biased to certain taxa? Did they occur more widely than the presently studied systems? This talk will have some answers and hopefully, prompt many questions.

Abstracts Wednesday 30th August

General Session

Silk moth tales: Historic records of Exotic saturniids and their link to the 1980s 'Republic of Pakuranga', Auckland.

Flynn, A. R.[1], Green, O. R.[1]

[1] *Previously at the Ministry for Primary Industries, Plant Health and Environment Laboratory*
Presenting author current address: 22 Pinewood Street, Avondale, Auckland 0600
email: flynnalan22@gmail.com

Tāmaki Makaurau/Auckland has a history of exotic insect introduction. With a substantial human population, proximity to air travel, multiple sites of goods import and a large trade volume, it is not surprising New Zealand's largest city is overrepresented as a locality in new exotic insect detections. There are many tales to tell, here is one. There is only one established saturniid moth in New Zealand (*Opodiphthera eucalypti:* Saturniidae (Scott, 1864), the emperor gum moth). Forty years ago, in the early 1980s four other species were the subject of a concerted, though misguided and illegal, effort at establishment. Something was happening in Pakuranga.
This presentation discusses what we know of these silk moth tales, the villains, the heroes and the triumph of biosecurity; at a time before the term biosecurity was even in use.

The New Zealand Threat Classification System needs you!

Murray, T.J.[1], Michel, P.[2]

[1]Department of Conservation, Fauna Science Team, 265 Princes St, Ōtepoti, NZ. email:tmurray@doc.govt.nz
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The New Zealand Threat Classification System (NZTCS) is a rules-based system used to assess the risk of extinction faced by organisms found in the wild in Aotearoa New Zealand. This includes the many invertebrate groups Entomological Society members work on. Although the NZTCS is administered by the Department of Conservation, it relies upon evidence and expertise from the wider science and conservation community. Assessments are made by panels of national and international experts and are based on current understanding of population size and trend, impacts of threats, recovery potential, and taxonomic certainty. Panels use information from databases, scientific publications, observations from the public, and expert knowledge. Upcoming assessments are listed on the NZTCS website (nztcs.org.nz) along with instructions on how you can contribute data and knowledge.
For highly diverse groups like insects and spiders, the NZTCS assessment process continues to be very challenging. NZTCS criteria and the thresholds applied are not always perfectly suited to interpreting invertebrate population trends, and quantitative population data are frequently lacking. Despite this, the NZTCS status is often the default metric used in prioritising species protection, management, and funding for conservation research. Therefore, it is essential that the entomological community proactively help to provide the best possible data and expertise to inform these assessments. This talk will provide a reminder for how Society members can directly contribute to the NZTCS process and improve the delivery of assessments for invertebrates.

Biosecurity

Fall armyworm (*Spodoptera frugiperda*) in New Zealand

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Fall armyworm (FAW), *Spodoptera frugiperda* (Lepidoptera: Noctuidae), is a plant pest that can feed on over 350 plant species, preferring grass crops, especially maize. On 16 March 2022, a suspicious hairy egg mass was found on the outside of a spongy moth, *Lymantria dispar* (Lepidoptera: Erebidae), surveillance trap in Tauranga. The egg mass was submitted to Plant Health and Environment Laboratory (PHEL) and the molecular diagnostic returned a 100% match to the exotic species, *Spodoptera frugiperda*. This initiated an MPI response with support from relevant Government Industry Agreement (GIA) members. PHEL was the sole provider of diagnostics for FAW during the response via images and specimens collected in the field, provided the response team with biological/technical advice, and updated the response team with positive detections. PHEL's key questions were: how did it arrive, distribution within New Zealand, would FAW survive the winter in NZ, and what plant hosts would be affected. MPI found that FAW was well established, could survive the winter in suitable areas of the country, and was unable to be eradicated, so the response was moved to long term management.

Identifying predators of eucalypt-defoliating paropsine leaf beetles in Marlborough

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New Zealand has grown Australian eucalypts since the 1960's for various end uses. The Australian paropsine beetles *Eucalyptus* tortoise beetle (*Paropsis charybdis*) and *Eucalyptus* variegated beetle (*Paropsisterna cloelia*) have been the most damaging. *Paropsis charybdis* has been present for over 100 years and subjected to classical biological control attempts with some success, whereas *Pst. cloelia* has been present for eight years and is now displacing *P. charybdis* in some plantations.
During the seasons 2021/22 and 2022/23, we surveyed the phenology of both paropsine beetles and the diversity and abundance of predatory arthropods in a *Eucalyptus bosistoana* plantation in Marlborough. We developed two species-specific qPCR assays to detect the DNA of the paropsines within the bodies of field-collected predators to confirm predator-prey associations. During the two paropsine generations, eight predatory insect species and seven spider families were present on the same trees as the paropsines. According to field observations, most species attack only eggs (not larvae). Combining abundance data and molecular results suggests that most species are minor predators, either because they appear in low numbers (e.g., Coccinellidae) or feed on paropsines infrequently (e.g., Araneidae). Some abundant species may have no association with paropsine beetles (e.g., Pisauridae). The native Schellenberg's soldier bug (*Oechalia schellenbergii*) was the most abundant insect species, attacking all paropsine life stages including adults, and 100% of samples tested positive for paropsines in molecular analysis.
Abundance of paropsine predators could be increased through conservation biocontrol measures as part of an integrated management approach that employs multiple strategies.

A look at New Zealand ant fauna in high-risk invasion sites

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During the National Invasive Ant Surveillance programme (NIAS), which is managed by MPI (Ministry for Primary Industries), sites that are at a high risk of ant invasion are surveyed annually for any exotic ant species. These sites, ports, marinas and 'high risk' transitional facilities (de-vanning sites), are the main entry points for ants entering Aotearoa. During the surveillance programme, every ant collected during the trapping programme is identified to species. This talk will give an overview of ant fauna found at these entry point sites. Examining the spread of different ant assemblages around Aotearoa can provide a useful perspective for protection efforts against ant invasions.

Portable electroantennograms – working towards a field-based tool for applied chemical ecology

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The active space, or attraction radius, of a pheromone source is extremely difficult to quantify in real-time at biologically active concentrations. Historically, pheromone plume structure experiments used odour source surrogates that have similar atmospheric behaviour to the target pheromone but are simple to quantify in real time. However, the biological significance and concentration thresholds of these studies cannot be quantified, as surrogates do not elicit an insect behavioural response. Portable electroantennograms (pEAG) can give us an insight to the insect's response to a pheromone source with the potential to further our understanding of the pheromone's plume dynamics in an open-field situation. Here, we report the development of a pEAG that is portable (both lightweight and small), can incorporate whole insects of a range of sizes (4 to 30 mm antennal length), has wireless communication, a standalone power supply, and record dual-channel antennae. This device has undergone comprehensive testing in large scale wind tunnels and preliminary trials in open air have begun. The pEAG is a promising first step towards the realisation of a myriad of new opportunities for future real-time analysis of in-field EAG responses. This will allow us to aim towards quantifying a biologically active structure and spatial extent of pheromone plumes, to advance our understanding of insect chemical communication within a complex landscape. This knowledge could be applied broadly to the development of improved surveillance and eradication technologies.

"What's this bug?" An analysis of five years of suspect pest insect notifications

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The Ministry for Primary Industries' Plant Health and Environment Laboratory (PHEL) receives many notifications each year of pests suspected of being new to New Zealand. Notifications are received through the Ministry's free Pest and Disease Hotline as well as a new online reporting tool implemented in March 2022. Notifications act as an early warning tool for possible pest species, as well as being an important source of surveillance data.
An analysis of regional, temporal, and organism specific notification trends is presented. During the period July 2018 to June 2023, PHEL received ~14000 notifications, with 51% originating from Auckland and Northland. January to March is the busiest period, receiving 40% of all notifications. Organisms reported include those relating to publicity campaigns targeting specific pests e.g. brown marmorated stink bug (BMSB), past incursion-response publicity (e.g. fruit flies, termites), and other suspect pest invertebrates. The brown soldier bug, *Cermatulus nasalis*, is the most frequently reported invertebrate (10.4%), likely owing to continued BMSB awareness efforts and its close resemblance thereto. Excluding targeted campaigns and incursion responses, the three-lined hoverfly, *Helophilus seelandicus*, was the most frequently reported (0.9%), followed by harlequin ladybird, *Harmonia axyridis* (0.8%).
The Exotic Pest and Disease Notification services continue to be a valuable tool in New Zealand's biosecurity system.

Assessing the risk of *Xylella fastidiosa:* Could native spittlebugs play a role in spreading the pathogen in New Zealand?

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The plant pathogen *Xylella fastidiosa* affects a wide range of plants, including some New Zealand native species. The pathogen is transmitted by xylem-feeding insects, including true spittlebugs (Aphrophoridae), a group with many native species present in New Zealand. This was the third year of a five-year project aimed at improving our understanding of the potential role of New Zealand's native spittlebug fauna as vectors of *X. fastidiosa* if the pathogen were ever found in New Zealand.
In the summer of 2022, transect sampling of spittlebugs in Auckland, Canterbury, and Otago in natural and productive areas was undertaken to examine spittlebugs' movement across different land-use borders. Collection kits were sent to interested members of the public to facilitate nationwide collections of specimens for molecular and range/plant host records. In addition, a molecular library of New Zealand spittlebug species has been started. Work is also underway to develop a method for identifying spittlebug species from the spittle mass.
So far, the transect sampling and collection kits have yielded only the introduced *Philaenus spumarius,* which was shown to cross from productive into natural areas. Additional targeted collections on native vegetation provided some native specimens, and new information on the range and seasonality of some species has been added. The molecular work has demonstrated that *Carystotera fingens,* particularly, show wide molecular variability. In contrast, the introduced *P. spumarius* shows minimal molecular variability. More specimens of native spittlebugs are needed to clarify the variability seen.

Department of Conservation Biosecurity Research Priorities

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The Department currently lacks a definitive list of invertebrate biosecurity topics for researchers to align their work with the highest relevance to DOC. Instead, these topics are scattered across various plans and strategic documents covering diverse areas such as climate change and ecosystem management. Which plans do or don't include mentions of biosecurity or pest management is also not clear at first glance. This poses a challenge for researchers seeking formal or informal support from DOC for their projects or guidance in selecting research areas that contribute to conservation efforts. Additionally, it hampers the department's ability to prioritize areas for investment or communicate which topics require attention and why, especially to specific research communities like entomological science. Here I present an overview of the various plans that indicate required and desired areas of biosecurity research. This serves as a starting point for further investigation and discussion, aiming to assist your permissions process, facilitate partnerships with DOC, or seek formal support for a research proposal.

Testing the Toolbox—evaluating methods for predicting the risk posed by biological control programmes

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Biological control programmes have been a major area of entomological research in New Zealand. Over the past century, there have been increasingly sophisticated efforts to predict the impacts of proposed agents prior to their release, an area of research which has been a major part of Better Border Biosecurity (B3) programmes. One way to estimate the reliability of these methods is to test them on systems which are already present in Aotearoa New Zealand. This research will conduct post-release evaluations on several biological control systems, including systems with plant targets and with insect targets. These study systems are:
1) Investigation of the impacts of *Mastrus ridens* (Hymenoptera: Ichneumonidae), a biological control agent for codling moth (*Cydia pomonella* (Lepidoptera: Tortricidae)), on non-target leaf-roller moth species.
2) Investigation of the impacts of *Chrysolina* spp. (Coleoptera: Chrysomelidae), herbivores on St John's wort (*Hypericum perforatum*), on native *Hypericum* species.
3) Measuring the stability of non-target parasitism rates of *Microctonus* spp. (Hymenoptera: Braconidae), intended to control pest weevils of pastures but known to attack native broad-nosed weevils (Coleoptera: Curculionidae).
4) Investigating the indirect effects of the impact of the leaf-miner *Phytomyza vitalbae* (Diptera: Agromyzidae), introduced to control old man's beard (*Clematis vitalba*), on the populations of parasitoid wasps which also attack *Phytomyza* flies on puawānanga (*Clematis* spp.).
This research will provide assurance that the methods and models developed for evaluating biocontrol agents have good predictability and thereby increase our confidence in the tools used during pre-release testing of potential biological control agents.

Kiwaia 'Cloudy Bay' (Lepidoptera: Gelechiidae), the mat daisy jumper moth: recording its last jump…?

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Discovered in 1999, this tiny flightless moth jumps on coastal mat daisies (*Raoulia hookeri*). The moth's habitat is a nationally rare gravel-field on the Marlborough coast. Monitoring and management of the only known population at Rarangi Beach began in 2000 and the last jumping individual was detected in 2017. Annual surveys continued till 2021. Initially, *Kiwaia* 'Cloudy Bay' were known continuously along a 1700 m x 80 m stretch of beach above high tide. But within a few seasons, they were only detected in a 100 m x 30 m area for 14 years before extinction. Fortunately, since the event, more such mat daisy jumper populations have been discovered, mostly on private land ~40 kilometres to the south. We report the failed conservation action designed to save the Rarangi Beach population and weigh learnings and implications for saving endangered invertebrates in Aotearoa.

Mat daisy jumper moth *Kiwaia* 'Cloudy Bay'. Image: Robert Hoare

Directing connectivity in the landscape for the maintenance of indigenous biodiversity

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Maintaining ecological connectivity, especially in increasingly fragmented landscapes, is crucial to ensure healthy and efficient functioning of ecosystems and to allow for the flow of species and ecological processes throughout the landscape. The National Policy Statement for Indigenous Biodiversity includes connectivity as part of the requirement to maintain biodiversity across Aotearoa New Zealand. Invertebrates have been largely neglected in considerations of resource management despite the varied roles invertebrates contribute to ecosystem functioning. In part this is because little is known of their dispersal across landscapes. As part of development of conservation strategies for community groups we have modelled connectivity for a range of native avian species to identify gaps and evaluate opportunities to protect, enhance, connect, and extend existing valuable habitats. The ArcGIS toolbox 'Linkage Mapper' was used to develop connectivity models for selected avian umbrella species. This method proved to be an effective tool to inform evidence-based, landscape-scale connectivity strategies and help prioritise conservation actions across large, fragmented landscapes.
This presentation will provide an overview of the connectivity assessment, but its main purpose is to seek <u>your input</u> into the opportunity and benefit of incorporating invertebrate species into the connectivity response. Attributes for consideration include how to apply at the landscape scale, the dispersal characteristics of taxa, habitat requirements, and whether the concept of an overarching umbrella species approach is helpful for assigning connectivity for invertebrates.

Testing outcome monitoring methods to measure invertebrate responses to landscape-level pest control

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Large-scale pest control programmes are becoming increasingly common in New Zealand. Most programmes report on the number of pests killed, but measuring the outcomes of control for the flora and fauna we wish to protect is less common. Often, outcome monitoring is considered nonessential because pest impacts are well understood for certain groups of species, and whole-ecosystem benefits are assumed by extrapolation. Incorporating outcome monitoring for invertebrates is particularly uncommon because they are frequently undervalued, despite the fact they are pivotal to the function and integrity of many ecosystems. Furthermore, the impacts of different pests and the level of control needed to alleviate those impacts to protect invertebrates are poorly understood. Rigorous outcome monitoring is therefore crucial in determining the most effective pest control tools, timing, and scale that will benefit invertebrates as key components of ecosystems, and in revealing any unintended consequences of control like impacts of meso-predator release. This talk reports on a current study where invertebrate outcome monitoring is incorporated into the 310,000 ha Te Manahuna Aoraki landscape-level pest control programme in the Mackenzie Basin. Monitoring was undertaken annually for three years at 15 sites ranging from 600 m to 2000 m asl. Because standard outcome monitoring methods are poorly developed, we targeted a suite of invertebrates (wētā, grasshoppers and large ground-active beetles and spiders) using three different methods (transect walks, tracking tunnels and pitfall sampling) to test and compare their relative utility for detecting invertebrate population trends. Here we discuss the design rationale and early results.

Poster Abstracts

Effects of Chlorothalonil on *Drosophila melanogaster* survival and fecundity

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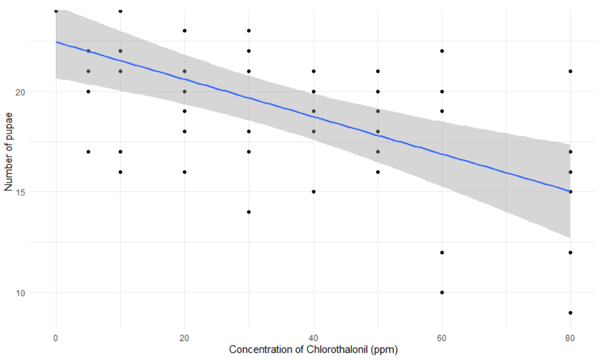
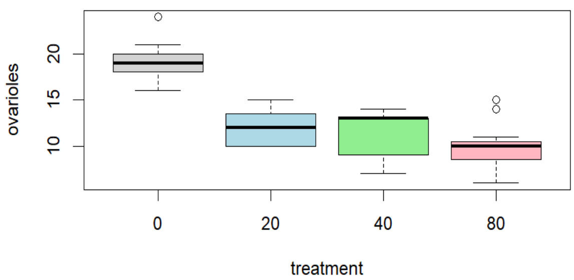
Agrochemicals have a wide range of effects on nontarget organisms. Chlorothalonil is an organochloride fungicide used in orchards as a canopy spray to control fungal diseases. Chlorothalonil is the second most-used fungicide in the world, after Sulphur. While chlorothalonil has been shown to affect vertebrate reproduction, only a few studies have explored its effects on insects. In the context of the recent decline of insect populations, there is an urgent need to understand the toxicity of widely used chemicals such as chlorothalonil. The starting point of toxicity testing of any chemical in an organism is the determination of its Lethal Concentration 50 (LC50). During my Master of Research, acute and chronic LC50 of chlorothalonil fungicide was determined in a non-target insect model, *Drosophila melanogaster*. The effect of chlorothalonil on larval pupation, as a proxy of larval survival. and the number of ovarioles in females, as an important determinant of fecundity, were measured. My first results show that the percentage of pupation decreases with increasing concentration of chlorothalonil. Exposure to chlorothalonil also drastically reduces the number of ovarioles in female flies. These data show that chronic exposure to chlorothalonil has important sub-lethal effects on fly survival and fecundity. Further work will explore the mechanisms that might be involved in these negative effects of chlorothalonil on insect fitness parameters.

Number of pupae after chlorothalonil exposure



Decreasing pupation rate with increasing concentration of chlorothalonil (LM, F=32.74, df=52, $p<0.001$)

Effect of chlorothalonil on ovariole number



The negative effect of chlorothalonil on the number of ovarioles (GLM (poisson), chisq=51.83, df=3, $p<0.00$)

Poster

Acoustic trapping for cricket control

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Black field crickets, *Teleogryllus commodus*, are significant pests of vegetable crops and pasture in northern areas of New Zealand. Crickets are currently controlled using bait containing malathion, limited to two applications per year owing to toxicity. This is supplemented with the use of broad-spectrum pesticides. However, pesticide resistance is a risk, and some pesticides will be removed from the market in 2024.
We aimed to develop a non-chemical control for the black field cricket by designing an acoustic lure and trap combination. To achieve this, we recorded calls from a range of male crickets in a temperature-controlled laboratory environment, then tested whether female crickets moved towards recorded calls. We then identified the most preferred calls and used those to test lure/trap effectiveness in the field by releasing lab-reared crickets.
To reproduce the male call, we used a Raspberry Pi, programmed in Python, to drive an auto-amplifier and speaker playing cricket calls. Crickets attracted to the call then fell into a pitfall-style trap. The acoustic lure/trap combination successfully attracted and caught significantly more crickets than the non-acoustic control trap. The acoustic lure was attractive at close range (2 m), but not at long range (32 m). This project has successfully proved that the concept of an acoustic lure to attract crickets can work. Further work is needed to refine the synthetic call and trap combination to maximise trap effectiveness and efficiency. This novel acoustic-based trapping system has excellent potential to help vegetable growers and other farmers with cricket pests.

Spread of *Pauesia nigrovaria*, biological control agent for giant willow aphid

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Pauesia nigrovaria (Hymenoptera: Braconidae: Aphidiinae) was released in 2020 and 2021 throughout New Zealand to control giant willow aphid (*Tuberolachnus salignus*). The earliest releases, and subsequent surveys to confirm establishment and spread were focussed on the North Island, where, by autumn 2022 we were confident the parasitoid was thriving. In addition, anecdotal reports of recovering willows and fewer vespid wasp issues suggested a positive and early impact in the North Island. However, a knowledge gap remained regarding the situation in the South Island, and thus 2023 survey efforts were focussed there. This poster shows a map of release sites and positive finds of *P. nigrovaria*, throughout New Zealand. Establishment and spread in the South Island has been confirmed, including spread of over 100 km from multiple release sites. Yet, the South Island surveys suggested that to date the parasitoid hasn't proliferated there to the extent that it has further north. This could be a result of the bulk of the southern releases occurring in the second release year, putting them one year behind, and likely also relates to cooler temperatures causing fewer generations per year. In any case, we are highly encouraged by the tenacity of this parasitoid and look forward to continuing positive impacts for beekeepers, for those that rely on willows for their various purposes, and for all who are not fans of vespid wasps.

Egg parasitoids survey of stink bugs in New Zealand – could resident egg parasitoids help against BMSB?

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Halyomorpha halys (BSMB), originally from East Asia, is a highly polyphagous pest regarded as one of the world's worst insect biosecurity threats. BMSB presents significant risks to the sustainability of New Zealand's food production and is considered a major economic threat. As part of a pre-emptive classical biocontrol research approach for BMSB, a three-year systematic survey of stink bug egg parasitoids in targeted regions of New Zealand was started in October 2022. The project aims to a) assess the presence/absence of *T. mitsukurii*, an egg parasitoid introduced in Australia in 1962 against the green vegetable bug, *Nezara viridula*, and known to be an effective parasitoid of BMSB, and b) identify resident stink bug parasitoid populations that may contribute to a future biocontrol programme against BMSB. The first field survey season, using NZ stink bugs sentinel egg masses, was conducted between November 2022 and March 2023. Preliminary data showed a reasonably low parasitism by egg parasitoids (only 2.79%). Two parasitoids species were recovered from sentinel egg masses: *Trissolcus oenone* (67.6% parasitism rate) and *Trissolcus basalis* (32.4% parasitism rate). Among the Pentatomids species, *Cermatulus nasalis* and *Montheitiella humeralis* showed the highest parasitism rates, while no parasitism was recorded on *Glaucias amyoti*. Parasitism of stink bug egg masses was higher in "agricultural/modified" than "native bush" sites. Additional egg parasitoid surveys of stink bugs, to be conducted in the next two summer seasons, will be key to gain a deeper understanding of the diversity and abundance of stink bug egg parasitoids in New Zealand.

Entomology Diagnostics for High-Risk Site Surveillance 2022-2023

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High Risk Site Surveillance (HRSS) is one of the surveillance programmes conducted annually by the Ministry for Primary Industries (MPI). This programme monitors post-border risk sites, primarily targeting trees and shrubs. The main objective of HRSS is early detection of new plant pests and diseases that may pose a biosecurity risk to native forests, forestry plantations, or urban trees. HRSS field work is administered by SPS Biosecurity and the suspect exotic samples are sent to the Plant Health and Environment Laboratory (PHEL) in Tāmaki.
The PHEL Entomology is an internationally accredited laboratory for morphological identification and also utilises accredited PCR tests and sequencing for invertebrate identification. The laboratory has the capability to identify a range of invertebrates including gastropods and terrestrial arthropods such as insects, mites, spiders, centipedes and millipedes. Molecular techniques may be used as the predominant method of identification for immature stages, or damaged specimens and are also used to guide or confirm a morphological identification. In the 2022-2023 season the PHEL Entomology team performed 405 instances of morphological identification and 136 molecular identifications for the HRSS programme. In some cases these identifications generated records of new distributions, host associations and also new to New Zealand species.

Poster

What is on my native/taonga plant? Is it fall armyworm?

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The first official detection of fall armyworm (FAW) (*Spodoptera frugiperda*) in Aotearoa New Zealand, was in February 2022. Much attention has been on its preferred hosts, i.e., maize and corn. Multiple native plant species and plants of significant value, in particular to Māori, are also identified as at risk to FAW. As part of any surveillance, correct identification of the insects present on these native/taonga plants is important. This poster presents 10 plant species and their known butterfly/moth/caterpillar fauna in New Zealand. These species are drawn from the *Pittosporaceae*, *Piperaceae*, *Passifloraceae*, *Convulvulaceae*, *Poaceae*, *Solanaceae*, *Curcurbitaceae*, *Brassicaceae* and *Asparagaceae* families. As we continue to manage and prepare for biosecurity incursions, producing resources that serve broader interests and audiences, including iwi/Māori-focused issues, are needed.

Exploring the nature of *Arhopalus ferus* (Coleoptera: Cerambycidae, Spondylidinae) pheromone attraction

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Cerambycid species of the Spondylidinae subfamily are distributed worldwide and are known for being prolific invaders that infest conifers. They are no strangers to NZ where *Arhopalus ferus*, the Burnt pine longhorn beetle, is well-established and requires monitoring at high-risk sites such as ports, airports, and sawmills. This monitoring is required as part of the requirements to meet pine log export standards set by the Ministry of Primary Industries (MPI), and its surveillance is highly reliant on trapping using a lure composed only of host volatiles. Over the past 15 years, research on cerambycid pheromones has expanded worldwide through the identification of more than 400 cerambycid pheromone attractants. Recent advances in cerambycid pheromone research have allowed for pheromones to be synthesized for use as lures in traps. More recently, the identification of the male-produced aggregation pheromone in *Arhopalus rusticus* has enabled investigations into the nature of *A. ferus* pheromone attraction. Here we present the initial progress of our research, using laboratory and field bioassays to identify the specific chemical components responsible for *A. ferus* attraction, which may be used to help develop pheromone-based monitoring tools in NZ.

Poster

Pollinator performance and cognition in semi-natural simple or complex floral environments

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The environment in which animals develop can influence their behaviour as adults. We compared the performance of bumble bees (*Bombus terrestris*) raised in florally simple or florally diverse environments inside a glasshouse. We tested associative learning of over 100 bees raised in either environment using the Free-Moving Proboscis Extension Response (FMPER). In the glasshouse, we also recorded flower visitation, colony-level foraging effort, and colony growth, as well as fruit production by plants. We discuss how floral diversity and semi-natural rearing environments may affect learning capacity, pollinator efficacy, and colony-level behaviour in bumble bees. Our results provide an important step in understanding the extent to which bumble bee health, cognition, and foraging behaviour is influenced by the diversity of the floral environment, and how a diverse floral environment may distract or enhance pollinator behaviour toward a focal crop plant.

How do invertebrate communities respond to native forest restoration in human-modified landscapes?

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Ecological restoration in New Zealand has a rich history and serves as a valuable initiative to address the impacts of human activities on ecosystems. The primary goal is to reestablish self-sustaining ecosystems with this relying on maintaining and restoring interactions between species. Key interactions include those between specialist herbivorous invertebrates and their plant hosts. In this study, we will compare the composition, functional diversity, intensity of herbivory and colonisation patterns of phytophagous invertebrates within restoration sites across both urban and rural landscapes in the Auckland region. The aim is to investigate the role of key environmental factors, such as restoration age and distance from source populations, in structuring diversity and ecosystem function. First, we will analyse natural history collection data to compare the composition of phytophagous invertebrates between restored areas and remnant forest patches. Second, Plant-SyNZ to identify different types of herbivores, bioassays and field observations will be used to assess variation in herbivory intensity by phytophagous invertebrates on native woody plants across restoration sites of different ages. Additionally, collections from these host plants will allow us to compare invertebrate composition and functional diversity. By shedding light on the influence of restoration age, habitat conditions and landscape context, and considering functional traits of invertebrates, our study will contribute valuable insights to the field of ecological restoration and promote more effective conservation strategies for New Zealand's unique ecosystems.

Seasonal patterns of emergence in the stick insect *Niveaphasma annulata*

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Niveaphasma annulata is a stick insect species endemic to Te Wai Pounamu. Relatively little is known about its lifecycle or ecology. We studied a population of *N. annulata* in an urban garden in Dunedin, with an aim to understand the seasonal patterns of emergence of different life history stages. Every second night, a standardised route was walked, and vegetation was scanned with a torch light to identify emerging *N. annulata*. The life-stage and sex (of adults) of emerged stick insects was recorded at each survey, and we also noted instances of mating when it was observed. We found significant seasonal variation in the abundance of different lifecycle stages of *N. annulata*. Adults were most abundant from April to June and August to October, with relatively low numbers in the summer months. There was a peak in nymph abundance from September to November, and sub-adults were most abundant from November to February. Mating occurred throughout the year, but in the summer months a higher proportion of adult stick insects were observed mating. Thus, our results suggest seasonal triggers for egg hatching, leading to the synchronous emergence of hatchlings around September to November. Our research is the first to describe in detail the seasonal patterns in abundance of *N. annulata* and provides a foundation for further understanding the ecology of this species.

Record of *Thrips hawaiiensis* (Thysanoptera: Thripidae) in New Zealand

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There are 13 species of the genus *Thrips* recorded from New Zealand, of which five species are endemic to New Zealand including *T. austellus, T. coprosmae, T. phormiicola, T. martini* and *T. obscuratus*. This is the first record of an established colony of *Thrips hawaiiensis*, found on gorse (*Ulex europaeus*) in Auckland, New Zealand. The molecular results indicated that the sequence shared over 99% identities with *T. hawaiiensis* from two specimens collected from Australia in the Barcode of Life Data System. *Thrips hawaiiensis* was recorded once from New Zealand in December 1961 based on a single female from Campbell Island. However, this record is uncertain. It is unlikely it would survive in the subantarctic islands because its current range is subtropical to tropical climates. *Thrips hawaiiensis* is highly polyphagous and is found in the flowers of many plants. This species is widespread across Asia and islands in the Pacific. Diagnostic characters of this species are provided in this poster.

Why voucher specimens matter

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You wouldn't state a fact in your paper without a citation. It is just as important to validate your identifications and for your work to be reproducible. Depositing a voucher specimen is the way to achieve this. It will enhance the impact of your scientific research, and depositing your specimens in an institutional collection may be a condition of collection permits and getting papers accepted. As your project deadline draws near, tasks like this can become overwhelming. We recommend contacting collections early on so they can support you; from required collection data and preservation methods to providing containers. Additionally, they may have specimens and data that could assist you in your research.
Our poster guides you through the process of depositing your scientific specimens with a natural history collection. Your specimens will be safely stored and documented for you, your lab and the wider research community, potentially hundreds of years into the future.

Abstracts: Thursday 31st August

Physiology & Behaviour

Beekeeping outside the box: innovative colony handling and hive architecture

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Traditional beekeeping practices were developed to support honey production and have remained relatively unchanged since the advent of the 'modern' beehive in the 1850s. In contrast, during that timeframe there have been tremendous changes in how honey bee-pollinated crops are managed. This disparity has resulted in tensions between beekeepers and growers, as beekeepers must decide each year whether they will dedicate their colonies to honey production or to pollination. Our data suggest that young colonies that are in the physiological state of establishing a new hive, may be better suited for efficient crop pollination than the mature colonies traditionally used for honey production and/or pollination. We are working with beekeepers and growers to develop practical strategies and support for novel management of honey bee pollination services. Our *'bee'spoke* pollination strategy is expected to increase total productivity and enable strategic decision-making for beekeepers, while increasing accessibility for pollination services to be provided locally by smaller-scale beekeepers. This presentation will discuss relevant scientific findings of the programme and highlight specific actions that can be taken to support relevant social priorities such as accessibility of science and environmental sustainability.

Are there differences in behaviour between the two colour morphs of the mountain stone wētā, *Hemideina maori*?

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A robust understanding of an organism's behavioural and ecological characteristics is an integral part of conservation; unfortunately, many of New Zealand's native insect fauna still show a degree of data deficiency in these areas. Predator avoidance behaviours are one such area, and where there are colour morphs in New Zealand native and threatened insects, potential differences in the behaviour of these morphs can often be under-investigated. The mountain stone wētā (*Hemideina maori*) possesses two distinct colour morphs, melanic and yellow, though the reason for this distinction is unclear. This study uses laboratory based assays to compare the behaviour of the morphs, including activity, refuge seeking, cohabitation, emergence and defensive behaviour. We observed emergence and cohabitation regularly, used video recordings to assay activity and refuge seeking behaviours, and measured defensive behaviours by probing individuals until a defensive response was displayed. Differences in all tested behaviours between colour morphs were non-significant; however, there were significant differences in defensive behaviour between sexes. We also discuss how defensive behaviours of *H. maori* compare with another tree wētā. Overall, the colour morphs in *H. maori* are similar in their predator responses and there may be a driving factor for melanism other than predation pressure.

Comparing dispersal potential between the threatened endemic katipō spider (*Latrodectus katipo*) and the invasive false katipō spider (*Steatoda capensis*) through behavioural assays

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Invasive species pose a significant threat to native biodiversity worldwide. In New Zealand, the katipō spider (*Latrodectus katipo*) may be facing increasing pressure from an invasive species, the false katipō (*Steatoda capensis*). The purpose of my research is to shed light on the threats posed to the katipō by the false katipō spider and explore their potential displacement dynamics. Here, I compare the dispersal potential of the katipō and false katipō through a series of controlled assays. I compared their climbing behaviour, exploration behaviour, and running speeds. I measured this by assessing the latency to climb a pole and the climbing speed, the latency to enter a maze, the distance travelled, and the speed within the maze, as well as the distance and speed when moving down a track while being coaxed with a paintbrush. The results to date indicate that the katipō emerge slower and move slower than false katipō. The findings of this study have important implications for the conservation of the katipō spider. Understanding differences in performance between these two species allows us to identify factors that may be contributing to competition.

A) Pole. B) Maze. C) Sprint Track.

Non-visual camouflage in Zopheridae beetles as a defence against predatory ants

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Camouflage research has increased significantly in recent years, allowing us to better understand the impressive evolutionary adaptations prey species use to avoid predator detection. The majority of this research focuses on visual camouflage, but it is important to remember that predatory animals use multiple senses to locate and recognise prey. Non-visual camouflage strategies are likely highly abundant among nocturnal animals and niche-specific organisms who dwell in hidden spaces. However, non-visual camouflage strategies are poorly known, having received little research attention. Using behavioural experimentation with ant predators, I assessed the effectiveness of strategies used by saproxylic beetles from the family Zopheridae. Many species of Zopherids in New Zealand have specialised cuticle morphologies that allow debris from their environments to adhere to their cuticles, known as debris cloaking. Our results show that debris cloaking significantly reduces detection by ants in addition to reducing the probability of attack should detection occur. It was also found that background habitat plays a significant role in reducing the likelihood of predation, with a background of bark significantly reducing the probability of detection when compared to an unnatural control background without bark. The results of this study provide some of the first experimental evidence for the adaptive significance of debris cloaking, and strongly suggest it to function as non-visual camouflage.

Investigating differences in behaviour between predator naïve and predator aware mountain stone wētā, *Hemideina maori*

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Anti-predator behaviour within insects includes a variety of responses and adaptations unique to each predator-prey interaction. When a predator or group of predators is absent from an insect's habitat, it may develop a naivety that would prevent it from adequately responding to a predation threat. Using mountain stone wētā (*Hemideina maori*), an ecologically important group of insects endemic to New Zealand, we aim to compare behaviours between predator aware and predator naïve populations. Some work has previously been carried out to identify some of these behaviours within wētā, but more remains to be done in order to establish a fuller understanding. While there are a number of mountain stone wētā populations across the South Island that are predator naïve and predator aware, one of the most ideal study locations is on Lake Wānaka islands Mou Tapu and Mou Waho. Mou Tapu is a pest-free island while Mou Waho is not, creating the perfect study system in which we can compare behaviours between the two populations. Understanding these differences in behaviour may have implications for how to best respond to predator introduction events, the effects of climate change on insect niches, and future potential translocations.

Who wins in competitive interactions between males of the iconic New Zealand stag beetle, *Geodorcus helmsi*?

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Animals with exaggerated sexually selected traits invest heavily into these traits to compete over access to mating opportunities. During these contests, each participant must make critical decisions about whether to continue fighting or retreat. These decisions are also known as assessment strategies. Like many other stag beetles, the males of the Helm's stag beetle, *Geodorcus helmsi* possess enormous mandibles that they use to grapple with one another. Despite how dynamic and charismatic these behaviours are, there have been no studies relating to the fighting behaviour of *G. helmsi*. We investigated the fighting behaviour of *G. helmsi* by randomly pairing male *G. helmsi* in a laboratory setting and measuring the duration of their initial interaction. We found that larger beetles won in aggressive interactions more often than smaller males. However, we were not able to determine whether *G. helmsi* use any specific assessment strategies during these interactions. However, these results, in combination with field observations, allow us to elucidate the fighting behaviour of *Geodorcus*. These results also give us key insights about important factors to consider relating to the conservation of these charismatic beetles.

The effect of nectar-borne microbes on the foraging behaviour and diet of European honeybees (*Apis mellifera*)

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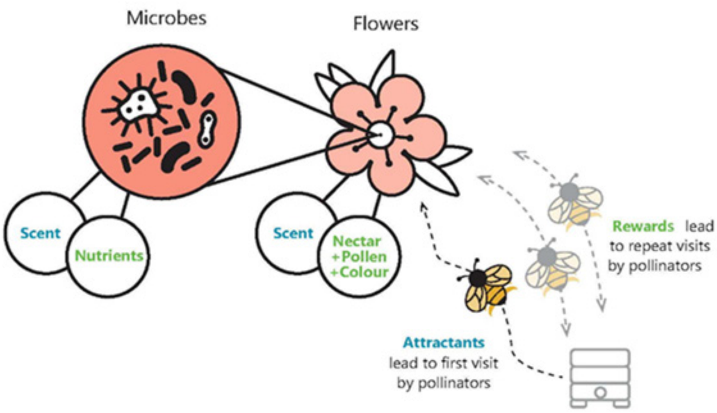
The evolution of flowering plants is intrinsically tied to the ecology of insect pollinators. Plants rely on pollinators to facilitate their reproduction, while the latter are rewarded with energetic resources (e.g. floral nectar). For humans, understanding and exploiting plant-insect relationships is essential for crop farming and food production.
As carbohydrate-rich microenvironments, nectar provide an ideal medium for specialised yeasts. Nectar microbes can mediate ecological relationships between plants and pollinators by altering nectar chemistry and providing pollinators with additional nutritional resources. By doing so, yeasts help plants attract and reward pollinators, in turn benefiting from geographical dispersal by insects.
To explore applications of this three-way relationship for agricultural development, we studied whether nectar microbes of mānuka flowers influenced the foraging of honeybees. We isolated six yeast species from mānuka nectar to use in behaviour trials testing food preferences of honeybee foragers. Preliminary results show yeast species-specific effects in food consumption rates by foragers, suggesting that bees prefer flowers inoculated with certain taxa. Additionally, biochemical profiling of the yeasts show that bee-preferred taxa may be more effective at absorbing nutrients from nectar, and potentially offering a more attractive food reward to pollinators. Our results indicate that honeybees select for specific yeast species while foraging, and ingestion of these microbes may offer an additional reward over nectar alone. These findings create an opportunity for management to optimise bee foraging in mānuka. We discuss the possible biological and evolutionary causes behind this preference, and its implications for the honey industry in New Zealand.



Snapshots of Aleocharine rove beetles (Staphylinidae)

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Aleocharinae get little love. Nor respect. With most species less than 3 mm in length, they are among the smallest beetles, difficult to dissect if you're all thumbs. Most coleopterists are unsympathetic, considering aleocharines monotonous by-catch of leaf litter extract. Their diversity alone is daunting with thousands of species worldwide. There are close to 200 described species in New Zealand but the actual number would surpass this two-fold. The aleocharine classification remains a mess because their unity of form has misled taxonomists. Put off already? Don't despair, I don't. The natural histories of aleocharines are vast and mind-blowing. Most are predatory and all are microhabitat specialists. Some are exclusively alpine zone, some are arboreal, some are intertidal which survive submersion into salt water. New Zealand aleocharines can be superabundant, yet they get short shrift. Not a single mention of them in classic New Zealand flower power studies. The riparian Tachyusini: super-common, super-rich, super-specialised; an untold tale of adaptive radiation. I will introduce fascinating aspects of New Zealand's Aleocharinae, including flower specialists, how one species lures their weevil hosts out from their wood borings, and the only known case of reverse conglobation in adult Coleoptera.

Introgression in New Zealand Fishing Spiders (*Dolomedes*)

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Introgression is the movement of genes from one species to another and has a profound impact on the phylogeny and evolution of taxa. Introgression is often described using only phylogenetic methods, with little focus given to the morphology and behaviour that drives and maintains it. This is despite the fact that introgression requires mating between species, therefore potentially involving concepts such as habitat usage, mate recognition, courtship displays, female choice, genital morphology and the mechanics of copulation, and mating systems, among many others. Understanding how these concepts promote and/or limit introgression in model species would aid our understanding of introgression.
Dolomedes (fishing spiders) is a genus of Pisauridae represented by four species in New Zealand, including two sister species: *D. aquaticus* and *D. minor*. Genetic evidence shows there is a one-way introgression between the two species, with only *D. aquaticus* females able to mate with *D. minor* males. This introgression is also geographically restricted, with introgression only occurring in the lower south of New Zealand's South Island, despite the two species' co-occurrence through much of the country. I will present results of my investigation of this unique introgression, using field surveys, laboratory crossing experiments and micro-CT analysis to investigate the behavioural and morphological factors that promote and limit it.

Foraging and nesting behaviours of ground-nesting bees in Dunedin

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Insect pollination is one of our main ecosystem services, contributing to ~75% of global food crops and 80% of wild plants. Bees are the key insect pollinators because they forage flowers for pollen and nectar. Out of 20,000 bee species, about 85% are solitary nesters. In New Zealand, we have 28 native ground nesting bee species, yet they have received less attention than honeybees and bumblebees due to their small population densities and seasonality. Consequently, we lack knowledge about their biology, particularly nesting and foraging behaviours. Our research focuses on understanding the nesting and foraging behaviour of native bees in Dunedin. We used video monitoring to observe the female bees to explore how nesting and foraging behaviour changes throughout the day and between different nesting sites. We recorded the time females spent in their respective tunnels, and the number and duration of foraging trips. Furthermore, we caught female bees and collected pollen to investigate whether they are specialists or generalists. We collected data from three native bee species, *Lasioglossum sordidum*, *Leioproctus fulvescens*, and another *Leioproctus* species. *Leioproctus fulvescens* foraged longer and more often in mornings than later in the day. *Lasioglossum sordidum* also foraged less during the afternoons. For both species, female foraging behaviour was similar between nesting locations. All species nested for similar amounts of time throughout the day and between sites. Our native bees are vulnerable to habitat loss and intensive pesticide use. By collecting some basic information on native bee biology, we hope to contribute to conservation efforts.

Unprecedented drought in Europe triggers declines in carabid beetles in a German forest area

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In recent years, there have been numerous reports about declines in arthropod communities – especially in Europe and North America. However, trends seem to vary across taxonomic groups, habitats and regions. Next to anthropogenic land-use climate change is one of the suspected drivers for these declines. Currently, Europe is affected by droughts that have been unprecedented in the past 500 years. Even temperate forests that have been considered to be relatively stable habitats able to mitigate weather and climate extremes have been severely impacted.
We analysed a 24-year dataset of carabid beetle (Coleoptera: Carabidae) samples from a temperate forest area in northeast Germany to investigate temporal trends and potential drought responses. We found significant linear declines in overall abundance and biomass during the study period (1999-2022). Non-linear trends were closely related to long-term droughts represented by the Standardized Precipitation Evapotranspiration Index (SPEI). Most severe declines took place after 2015 (mean: -65% abundance / -90% biomass). Negative trends in species richness and evenness as well increasing temporal species turnover indicated significant shifts in the carabid community. Declining and drought sensitive species tended to be larger and have lower dispersal abilities.
Our findings are in line with other studies on long-term trends and drought responses in carabid beetles. However, they represent the very first evidence of the impact of recent droughts on forest insects. We expect further declines and continuing shifts in species assemblages of forest carabid beetles under progressing climate change.

Are big jaws a big problem for New Zealand's ugliest bug?

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Sexual selection has driven the evolution of weaponry for males to fight rivals to gain access to females. Although weapons are predicted to increase males' reproductive success, they are also expected to incur costs and may impair functional activities, including foraging. Using feeding assays, we tested whether the enlarged mandibles of Auckland tree wētā (*Hemideina thoracica*) impacted feeding activity (the total volume of biomass consumed, bite rate, and number of foraging visits) and foraging behaviour (time spent moving, feeding, or stationary). We predicted that increased mandible length in male wētā would hinder their feeding rates, as the muscle attachments favour strength rather than speed. In addition, the jaw mechanics do not allow simultaneous specialisation in both velocity and force. However, contrary to expectations that weapons impede functional activities, our results demonstrated that traits, which become exaggerated by sexual selection, can improve the performance of every-day activities. While males spent significantly more time moving but consumed a lower volume of biomass compared to females, we found that wētā with longer heads fed at a faster rate and spent less time foraging than wētā with smaller heads, regardless of sex.

Chemical Profile Analysis of New Zealand Native Bees, 'Ngaro huruhuru'

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Under the current threats of climate change and loss of biodiversity, it is important to better understand the ecology of pollinators, upon which 80% of our food production depends. Despite the recognized importance of solitary bees' contributions to the free ecosystem services of pollination, little is known about their nesting ecology. 'Ngaro huruhuru,' New Zealand native ground-nesting bees are *taonga* (valuable treasure) species to Māori and have proven to be effective pollinators of vital crops such as apples, blueberries, kiwifruit, and arable crops. They are solitary bees but often can be found in large-aggregation colonies formed of several hundreds of nests made from different species. To better understand and manage their populations in the future, we aim to identify the mechanism by which they form aggregation colonies. Using Gas Chromatography-Mass Spectrometry, we first extracted and analysed the cuticular hydrocarbons and the Dufour's gland secretions associated with nesting behaviour from six New Zealand native bee species from the genus *Lasioglossum* and *Leioproctus.* The analysis identified the presence of various compounds such as hydrocarbons, esters, aldehydes, and fatty acids common across several species within a genus, as well as some species-specific compounds. These findings serve as a foundation for comprehending the chemical ecology of New Zealand's native bees, with the intent of improving their conservation and management. The principles of *kaitiakitanga* were applied and integrated throughout this work thereby contributing towards a greater awareness of the importance of Ngaro huruhuru culturally and as an integral part of New Zealand's rich natural history.

Developing a method of molecular analysis of scats for estimating diet of the European hedgehog *(Erinaceus europaeus)*.

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Since introduction to New Zealand by early European settlers, the European hedgehog has spread throughout many habitats and thrived. Being insectivorous, the hedgehog threatens much of New Zealand's endemic invertebrate fauna, as well as lizards and ground nesting birds. The control of hedgehogs has been through trapping, however, there are limited standardised methods for hedgehog control, which can impact the success of control efforts. Previous studies on hedgehogs have focused on hand sampling of scat and stomach contents, which limits observations to remnants of hard bodied invertebrates. However, the identity of soft bodied invertebrates in a hedgehog's diet is largely unknown. Molecular methods of estimating diet have successfully shown a wider range of diets of the New Zealand fur seal and spiders in pasture.

For this study I will be using molecular techniques including species specific primers, metabarcoding and measuring DNA degradation to further investigate the terrestrial arthropod diet of hedgehogs from Kaitorete Spit. The outcome of this study will be used to determine which species may be at risk from hedgehogs and would likely benefit from ongoing control programmes to remove hedgehogs.

A temperature-based phenology model for *Tamarixia triozae*, a parasitoid of *Bactericera cockerelli*

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Climate change poses novel challenges to modern pest management strategies, including biological control. It will significantly impact the abundance, distribution, and behaviour of crop pests and their natural enemies. Understanding the temperature-dependent development of both the pest and its parasitoids is crucial for planning effective biocontrol programs and assessing their potential synchrony under varying climatic conditions, including future global warming. The tomato potato psyllid, *Bactericera cockerelli* (Sulc), is an invasive pest that has recently invaded Australasia from its native region in North America. *Tamarixia triozae* (Burks) is a primary biological control agent that was introduced in New Zealand. We utilized a deductive modelling approach to develop comprehensive temperature-based models for *T. triozae*, allowing for the prediction of population growth potential in New Zealand. The parasitoids were observed to complete their life cycle at constant temperatures ranging from 10 to 32°C. The model predicted survival limits at around 10°C and 32°C. *T. triozae* immature development rates were best fitted using Janisch-1 for eggs, Taylor for larvae, and Janisch-2 for pupae. The intrinsic rate of increase (r_m) reached its peak at 26°C, measuring 0.1476. The maximum population growth is expected around 27.67°C, with a finite rate of increase (λ) of 1.15279, which corresponds to a population doubling time of 4.87 days. The highest values for the gross reproduction rate (GRR) and net reproduction rate (R_0) were found between 22°C, while the shortest mean generation time (T) was observed at 30°C (17.58 days). We present the use of the phenology model in the context of classical biological control of *B. cockerelli*.

Evaluating ecologically sustainable ways to disrupt the ground wētā -vine association.

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Habitat modifications through agricultural intensification have led to population declines of many endemic insect species in New Zealand, but this is not the case with an endemic species of ground wētā (*Hemiandrus bilobatus*) that has caused significant yield losses to vine production in Awatere vineyards. My studies are centred on developing sustainable control measures through understanding the ecology of the insect by comparing its diet in natural habitats and in vineyards and understanding what controls burrow distribution and abundance. To improve our understanding of ground wētā ecology, I have analysed the diet composition of three sympatric wētā species: *Hemiandrus electra, Hemiandrus* 'disparalis', and *Hemiandrus nox* from forest habitat near St Arnaud*.* In this study, I hypothesised that all three wētā species would be omnivores, but the relative proportions of plant and animal matter might differ among species and sexes. My findings show that these three species have varying diet preferences although they occupy the same forest. Additionally, I have used three body dimensions and naïve Gaussian mixture models clustering (a machine learning tool using an unsupervised learning approach without *a priori* labels) to identify five size clusters (putatively corresponding to instars) allowing me to compare the abundance of each age category from monthly sampling. Juveniles and adults of *Hemiandrus electra* were caught from November to May. Such knowledge helps better understand *Hemiandrus* lifecycles in natural environments and may help develop sustainable control measures.

A thorn amidst the roses: Improving invertebrate diversity in rose gardens

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Agrichemical use is one of the leading drivers of insect decline. Increasing health and environmental concerns about chemicals has led to a decline in use in many horticultural contexts, including in the cultivation of roses. This study examines the impacts of different management regimes on invertebrate diversity in 10 Auckland rose gardens. An index of pesticide intensity indicated most of the gardens had very low pesticide levels, while two gardens had moderately high levels. Heavy metal concentrations in surface soils were elevated above background levels (particularly lead and copper), although all soils met the criteria for ornamental gardens in New Zealand. A total of 2449 invertebrates were collected from leaf litter samples, across 19 families. Pitfall traps collected another 2939 invertebrates across 23 families. Collembola were most commonly collected, followed by Formicidae and Talitridae. Only six species of Coleoptera were collected in low numbers, and all of those were exotic species. Collections were likely affected by the extremely wet conditions experienced in Auckland in summer 2023. Spray intensity was found to have no statistically significant impact on invertebrate diversity, abundance or taxa richness. In contrast, invertebrate communities were found to be most diverse and abundant in gardens with high vegetation diversity. Growing roses without using pesticides in gardens with higher plant diversity is likely to encourage the presence of beneficial invertebrates and greater overall invertebrate diversity.

Isolation by rock stack? Genomics reveals metapopulation dynamics of alpine wētā

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The mountain stone wētā, *Hemideina maori*, is a large flightless species that lives under rocky outcrops ("tors") across alpine regions of Southern New Zealand. There are two distinct colour morphs in this species, a melanic morph and a yellow morph. Previous research, based on mitochondrial sequencing, suggests that these two colour morphs diverged ca. 1 Ma, with a potential hybrid zone existing on the Rock and Pillar Range (Central Otago). We sampled wētā from 28 tors across this putative hybrid zone, and used genotyping-by-sequencing to assess the extent of movement between tors, test for genome-wide differentiation between the different colour morphs, and examine evidence of admixture. We found a remarkably high level of genetic structure – with populations only 100m apart genetically distinct from one another – indicating there is very limited movement between tors. The yellow and melanic morphs were genetically distinct, with a narrow zone of admixture where the lineages overlap. Future research will explore the genomic basis of melanism in this species, and test whether climate change is shifting the distributions of the melanic and yellow lineages.

Utilization of mitochondrial genes for species identification of *Bactrocera* fruit flies (*Diptera: Tephritidae*) from the Pacific Islands

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Many *Bactrocera* fruit fly species from the Pacific Islands have the potential to invade New Zealand, a country free from the pests, due to their rapid dispersal ability, broad host range and increasing international trade. Ability to rapidly and accurately identify species is essential to take appropriate phytosanitary measures.
Taxonomic identification of *Bactrocera* species at the immature stages is challenging. DNA barcoding is widely used for species identification. However, limited DNA barcode information available for Pacific fruit fly species is a barrier for its use.
To establish a more reliable molecular identification system, cytochrome c oxidase subunit I (COI) sequences were analysed for concordance between morphology-based and DNA-based identifications. A total of 289 primarily male adult specimens among 15 *Bactrocera* species from Cook Islands, Fiji, French Polynesia, New Caledonia, Samoa, Tonga and Vanuatu were investigated. The average genetic distances between species were 0.113 (0.000-0215) whereas that within species were 0.008 (0.000-0.047), indicating insufficient resolution at species level. For instance, COI barcode cannot discriminate between one clade of *B. facialis* and *B. passiflorae.*
As mitochondrial genomes can provide more informative molecular markers and more sequences are becoming available for a larger number of species, we also assembled 55 complete mitogenomes for 14 *Bactrocera* species using Illumina sequencing. The interspecific variation in the mitochondrial genome was sufficient for differentiation of most species based on multiple sequence analysis.
In summary, the use of COI barcoding and mitogenome sequences has increased the reliability of *Bactrocera* species identification that will better inform future biosecurity actions.

Population genomics of an iconic stag beetle

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New Zealand is home to many endemic beetles, the largest of which are the stag beetles, including the impressive *Geodorcus* stag beetles. These large, flightless, slow-moving beetles are disproportionately easy prey for birds, rats, and pigs. *Geodorcus* spp. are also likely to be targeted for illegal collection as several species are critically threatened, thus increasing their value. Many species of *Geodorcus* now have very small ranges, being restricted to one or a few small islands or mountain peaks, and are sensitive to habitat destruction. Helm's stag beetle, *Geodorcus helmsi,* is the only widespread species in the genus, with a geographic distribution extending from Stewart Island up to Karamea, near the top of the South Island. Preliminary genetic data indicate there may be significant genetic structure in this taxon, suggesting it may include a number of cryptic, reproductively separate species. We used a genotyping-by-sequencing approach to assess genetic structure and diversity across the geographic distribution of *G. helmsi*. We found significant genetic structure – with each population forming its own genetic cluster – suggesting there is very limited gene-flow across populations. Genetic diversity varied across populations, with notably higher levels of heterozygosity in beetles from rodent-free regions. Further investigation is required to better understand the species status of the distinct lineages, and how predator density impacts genetic diversity in these iconic beetles.

Detection and monitoring fruit fly pests (Diptera: Tephritidae) using traditional insect traps in northeast Libya.

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In Libya, there are two endemic tephritid fruit flies; the Mediterranean fruit fly (Medfly) *Ceratitis capitata* (Weidemann) and the olive fruit fly (olive fly) *Bactrocera oleae* (Rossi) that threaten the fruit and olive cultivation. The exotic peach fruit fly *Bactrocera zonata* (Saunders) has been recently recorded in the northwestern part of Libya with no official evidence of its presence in the northeast part of the country. One of the most essential strategies to monitor and detect insect pest movement is trapping systems which play a major role in tephritid fruit fly management . The aim of the study is to use simple insect traps according to the available resources to monitor endemic fruit flies and detect any fruit fly pests that may be invasive in northeast Libya. Three study sites were selected in important fruit growing areas in the northeastern part of Libya including: Tobruk, Darnah and El-Bayda. Two types of traditional traps were randomly hung in a mixed fruit orchard at each site. In overall, more tephritid fruit flies (medfly and olive fly) were captured in Tobruk site (46.43%) compared to Darnah and El-Bayda sites (25%, 28.57% respectively). This study confirmed the presence of medfly *C. capitata* and olive fly *B. oleae* in northeastern Libya, but no record of the peach fruit fly *B. zonata* or other tephritids. We discuss how these simple traps could assist monitoring tephritid population in fruit orchards for improving fruit fly control.

Abstracts: Friday 1st September

Taxonomy & Systematics

Morphological characters for the diagnosis of New Zealand zopherid beetles (Coleoptera: Zopheridae)

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Zopheridae are a particularly diverse group of beetles within New Zealand. The taxonomy of the native fauna has been little changed since early descriptive work, and revision is needed for certain genera. Due to the tendency of some species to accumulate debris on the body, the cuticular surface is obscured and other characters are needed for reliable diagnosis. One especially important synapomorphy is the loss of labial palps in a group of related genera. Other informative characters include nodules and carinae on the elytra, the shape, colouration, and chaetotaxy of setae, and the outline of the pronotum from above. High resolution images of specimens are critical for examination of characters which are fine in scale and not easily seen under a microscope or in available type images. Specimens have been taken on loan from several institutions and private collections in New Zealand as well as the Natural History Museum (NHM) in London. Photographs have been taken of these specimens and others housed in the New Zealand Arthropod Collection (NZAC). This has resulted in description of a set of morphological characters useful for generic diagnosis and delimitation, allowing the development of genus concepts consistent with recent phylogenetic analyses.

An attempt to reunite the pacific bounty hunter, *Pacificana cockayni* Hogg, 1904, with its family

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Pacificana cockayni Hogg, 1904 is a large spider endemic to the Bounty Islands, which are a small, isolated group of 13 granite islets and numerous rocks in the South Pacific Ocean (47.75°S, 179.03°E). This species was known only from females until now and was originally placed in the Agelenidae, then transferred to Amaurobiidae, then to Amaurobioididae and it now is *incertae sedis* in Miturgidae. We have examined recently captured males and found that they possess paired retrolateral stridulatory spurs on the trochanter of the male pedipalp and an associated stridulatory field on the prolateral face of male coxa of leg I. This feature is also found in males of the two New Zealand genera *Otira* (Amaurobiidae) and *Pakeha* (Cycloctenidae), and the Australian genera *Oztria* and *Storenosoma* (both in Amaurobiidae). We sequenced a 1189 bp fragment of cytochrome *c* oxidase subunit 1 (COI) in the hope that a phylogenetic analysis might reveal which family it should be placed in but alas we are none the wiser. We place it in Amaurobiidae for now and hope that future phylogenetic analyses with more genes and taxa resolve its placement and the placement of other troublesome marronoids.

A long time coming: a taxonomic revision of the genus *Isoplectron* Hutton, 1896 (Orthoptera: Rhaphidophoridae)

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The cave wētā genus *Isoplectron* was established by Hutton in 1896 and originally included two species, the type species *I. armatum*, and *I. calcaratum*. Two more species, *I. cochleatum* and *I. aciculatum*, were described by Karny in 1935 and in 1937 respectively. *Isoplectron cochleatum* has since been moved to the genus *Pharmacus* Pictet & de Saussure. During a period spanning two decades starting in 1954, Australian entomologist Aola Richards published a series of 15 manuscripts in which she described or re-described most of the New Zealand Rhaphidophoridae fauna. In her work, she also established seven new genera of cave wētā. She did, however, entirely ignore the smaller cave wētā in the genera *Isoplectron* Hutton, 1896 and *Neonetus*, Brunner von Wattenwyl, 1888. This has two implications for the taxonomy of New Zealand Rhaphidophoridae: firstly, the genus *Isoplectron* has never been revised since it was first described nearly 130 years ago. Secondly, we cannot be certain that all new genera described by Richards were actually new to science. In this presentation, I discuss the preliminary results of our work revising the Rhaphidophoridae genus *Isoplectron*. I also discuss the ecology and the life history of this enigmatic genus of cave wētā.

From the mountain to the sea: a checklist of the diversity and habitats of the chironomid midges

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The Chironomidae (non-biting midges) are amongst the most diverse and abundant forms of aquatic insect life globally and in New Zealand. Over 120 species from 11 subfamilies are known from NZ and they occupy almost all freshwater habitats as well as the coastal zone. This presentation will update a current checklist of the taxonomic knowledge of the NZ chironomids, along with an overview of the known and lesser-known species and their associated habitats. The fauna draws from the more cool-adapted austral realm as well as warm-water northern affiliations. The adaptation of this group across a diverse range of habitats includes glacial pools, geothermal hotspots, mountain refuges, commensal piggybacks, hygropetric seepages and coastal trickles.

Population dynamics of glow-worms *Arachnocampa luminosa*

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The "Trans-Tasman Glow-worm Committee", a collaboration between Queensland University Otago University and Te Papa, are a team of very different scientists that have come together to find out more about the New Zealand glow-worms initiated by a catalyst fund of the Royal Society New Zealand.
Some of our team examine the chemistry of the bioluminescence, others whether glow-worms from different geographic regions have been isolated in the caves long enough to become genetically different.
Therefore, we sample and analyse glow-worms from across the country to extract the DNA while some are reared to adulthood for morphological analysis. This allows us to compare populations in caves and forests.
Additionally, the glow-worms are a great model to analyse the ecology of insects with restricted dispersal ability. The outcomes will have fundamental scientific value to the study of the model of the 'adaptive-shift' (the active colonisation of the subterranean environment leads to adaptive differentiation of surface and cave populations through reduction in gene flow and, eventually, speciation). This study is also directly relevant to iwi and to ongoing c management of populations subject to conservation and/or tourism.
An intriguing finding so far is that one population on the South Island might be an unidentified new species. They show extremely different DNA sequences to other glow-worm populations of the South Island, such as those found in the Fiordland region only a few hundred kilometres away.

Hundreds of snares in Ruakuri; Female "glow-worm" emerging from the pupal case in captivity;

Latest updates on New Zealand's landhopper fauna (Amphipoda: Talitroidea)

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Currently, 28 species of native landhopper in 17 genera have been described from New Zealand, all of which have been attributed to the family Makawidae. The assignment of New Zealand's landhoppers to genera has been imprecise and equivocal but is now on a more stable path. Minimal morphological variation and diverse combinations of characters within and between taxa lead to challenges in interpretation. Also, extensive homoplasy and re-emergence of ancestral character states following periods of suppression continue to confound taxonomists. Here, we present evidence that the New Zealand landhopper fauna is much larger and more diverse than previously thought. Currently, the most significant contributor to this increase is the existence of many species complexes, including in such well known taxa as *Puhuruhuru aotearoa* and *Parorchestia tenuis*. Some of these consist of more than eight species. It is evident that what were (until recently) considered intraspecific morphological differences have proved to be interspecific or even intergeneric differences. There are also many undescribed species in at least seven major clades that have no clear affiliations with described genera. Most of these belong to the Makawidae. However, two of the seven clades belong to two families other than Makawidae, which, when formally described, will triple the number of talitroidean families represented in New Zealand. At 28 species, our described fauna is already dwarfed by the 52 documented undescribed species. DNA sequencing has been critical for understanding the New Zealand landhopper fauna, but knowledge is still incomplete.

Alfred Philpott and the Phantasmagorical Fungivores

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The pioneering Alfred Philpott illustrated the genitalia of many of the New Zealand 'Tineidae' (Lepidoptera) back in 1927. He revealed some extreme morphological peculiarities, notably in the genera *Eugennaea* and *Eschatotypa*, as well as in some '*Tinea*' species, but did not alter the classification. It has subsequently been suggested that these genera may belong to Dryadaulidae (formerly Tineidae: Dryadaulinae), but in many respects they are almost polar opposites of *Dryadaula* in structure and do not fit the current definition of the family. Very little has been published on these moths since Philpott's day. New work on the biology and morphology of the '*Eschatotypa* group' shows it to be an unexpectedly diverse but probably relictual lineage with such bizarre structural modifications that Gaden Robinson referred to one species as a 'morphologist's nightmare'! My investigations of the morphology of the group, as well as the discovery of the previously unstudied fungivorous larvae, are pointing the way to a more robust systematic placement. This is supported by molecular phylogenetic work (by Niklas Wahlberg) in progress. The group appears to be nearly endemic to New Zealand, but some intriguing clues suggest that they may occur, or once have occurred, elsewhere in the world.

New tools for rapid imaging and digitisation of pinned insects

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The digitisation of biological collections is critical for scientific research, conservation, and education. However, digitising collections can be a complex and time-consuming process that requires specialised expertise and equipment. This is particularly true for pinned insect specimens that are tiny and may have multiple obscured labels stacked on a pin. Digitisation of pinned specimens in Aotearoa is typically done by manually transcribing label data. At current rates, this represents a decadal problem. Automated mass digitisation systems are established in some collections overseas, but these systems can take up large amounts of physical space (>100 m2) and are prohibitively expensive. New Zealand institutions tend to have very limited space and resources, and so need a modular and more customised approach to mass digitisation. We have developed new, semi-automated tools for quickly capturing label and specimen images. These images can then be handed-off to machine learning pipelines (still in development) that automatically extract label data before parsing to collection databases. Here we describe two tools, the RAked Pinned Insect Imaging Device (RAPIID), and a downscaled version, RAPIIDlite. The hardware for these image systems is modular and customisable to user needs, and both include standalone GUI apps developed in the python environment that enable use by non-experts. Our initial testing indicates these tools will not only greatly speed up the digitisation process, but will help standardise processes and reduce error rates.

On the move: relocating the Canterbury Museum spirit collection.

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In April 2022, Canterbury Museum began planning for all the contents in the building to be moved, to commence a significant 5-year redevelopment project. All collections were moved, including the spirit collection, which contains a huge number of important invertebrate specimens. The collection is stored and preserved in circa 6,000 L of class 3 flammable liquid (predominantly ethanol); several issues arose that needed to be addressed. This talk will highlight several key features of the process including, planning, preparation, packing and the actual move. Sharing this process will provide context and information for other collections planning and implementing moves of spirit preserved collections of invertebrates.

Planning and strategy for accelerating digitisation of the New Zealand Arthropod Collection

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The New Zealand Arthropod Collection (NZAC) is the world's largest collection of terrestrial invertebrates from New Zealand. The NZAC is housed at Manaaki Whenua – Landcare research and contains approximately 7 million preserved specimens. The data related to these specimens includes where and when they were collected, and taxonomic information. In addition, there are often details on microhabitat, and biotic associations, such as host plant. For most specimens this information is only contained on the physical labels housed with them. Collections such as this, currently available in analogue form only, are largely inaccessible to researchers that cannot physically visit the collections. Access to the data associated with these collections facilitates work in many areas, including land management, conservation, biocontrol, and systematics. Digitising is the process of converting analogue information to electronic/digital format. Digitising is the accepted standard approach for biodiversity collections to unlock this information and make it accessible for a much wider audience. The NZAC plans to strategically integrate processes and workflows to accelerate digitisation. We will also enrich the data by linking additional information, beyond what is found on the physical labels, such as trait measurements, images, and DNA sequences. This type of data results from curation and research. If this data is not linked to the digitised records, it is at risk of being dis-associated from the specific specimen. Once digitised NZAC data is publicly available online via web portals including Manaaki Whenua's Systematics Collection Data website, and the Global Biodiversity Information Facility.

Tracing the journey of Canterbury's Wallace beetles

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Unbeknownst to most, Canterbury Museum holds 30 exotic beetles in their international collection with pinned labels bearing the name Wallace. These few insects, collected over 160 years ago, are a surviving memento of one of the most famous explorers and naturalists of the 19th century. A contemporary of Charles Darwin, Alfred Russel Wallace is most renowned for independently formulating the theory of evolution through natural selection. In 1854, Wallace set out from England to explore the Malay Archipelago, spending eight years collecting and studying the fauna of these beautiful islands. In this talk, travel back in time as we explore the provenance of these exotic specimens and the surprising route through which they found their way to Waitaha Canterbury.

On the move: relocating the Canterbury Museum pinned insect collection

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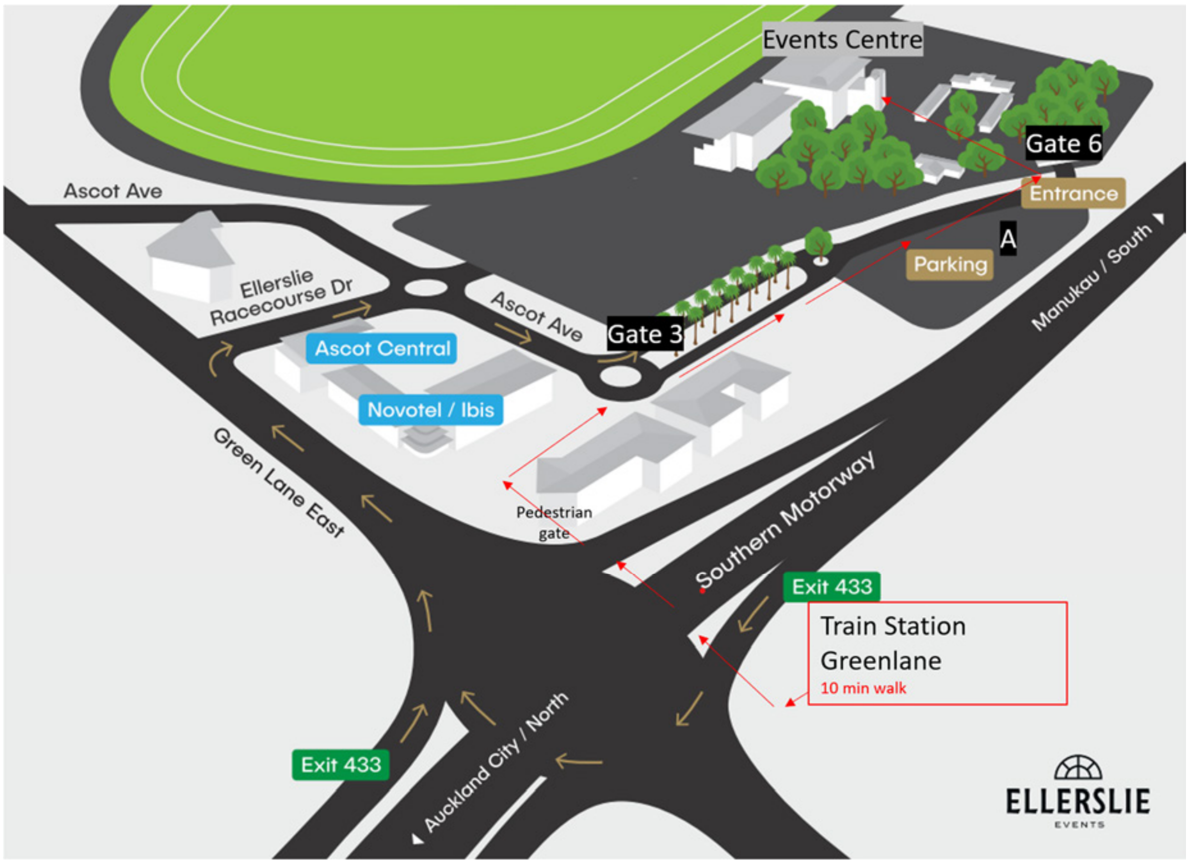
Over the last year the entire contents of Canterbury Museum have been packed up and moved to temporary facilities in preparation for the Museum's redevelopment. The planning, packing, moving, and set up process became the main priority of the Museum team, requiring a huge dedication of time and energy. The pinned insect collection contains many significant and fragile specimens and their relocation had to be handled with great care to ensure they all arrived at their new temporary home safely. A fantastic team of people worked tirelessly towards this outcome, checking, and securing where necessary, every specimen prior to their move. We hope highlighting the key parts of this process and discussing some of the successes and challenges will help to inform the moves of collections in the future.

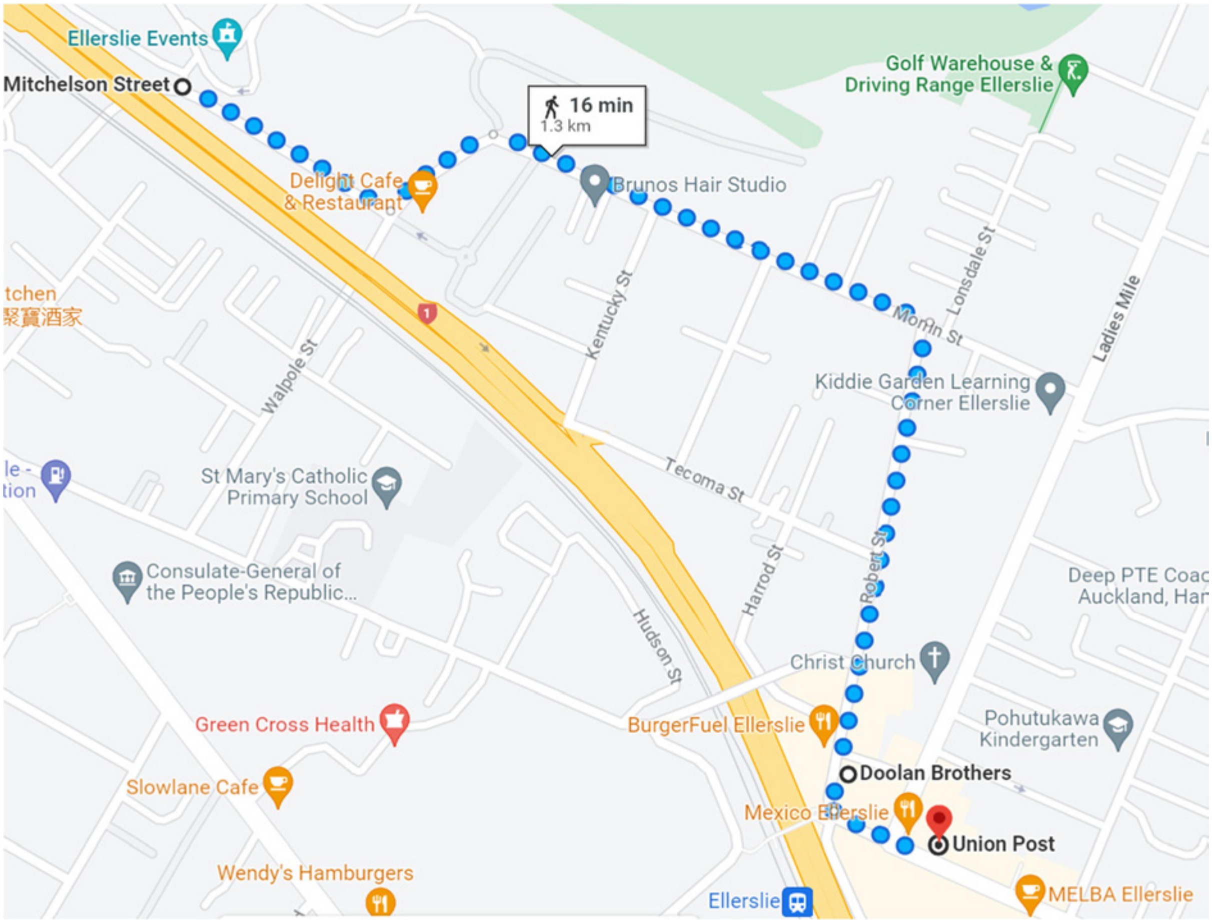
Maps

Getting there Map A



Site Map B

Ellerslie Pubs Map C



Conference Art

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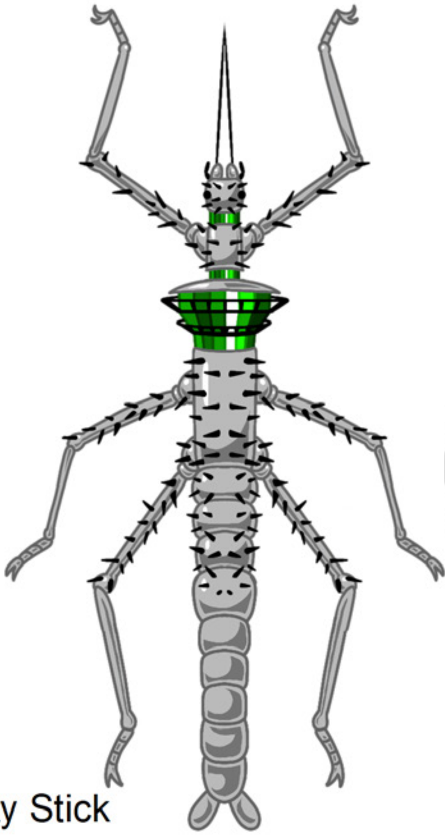
Aaron Harmer

Asia M King



Sky Stick

Molly Flynn