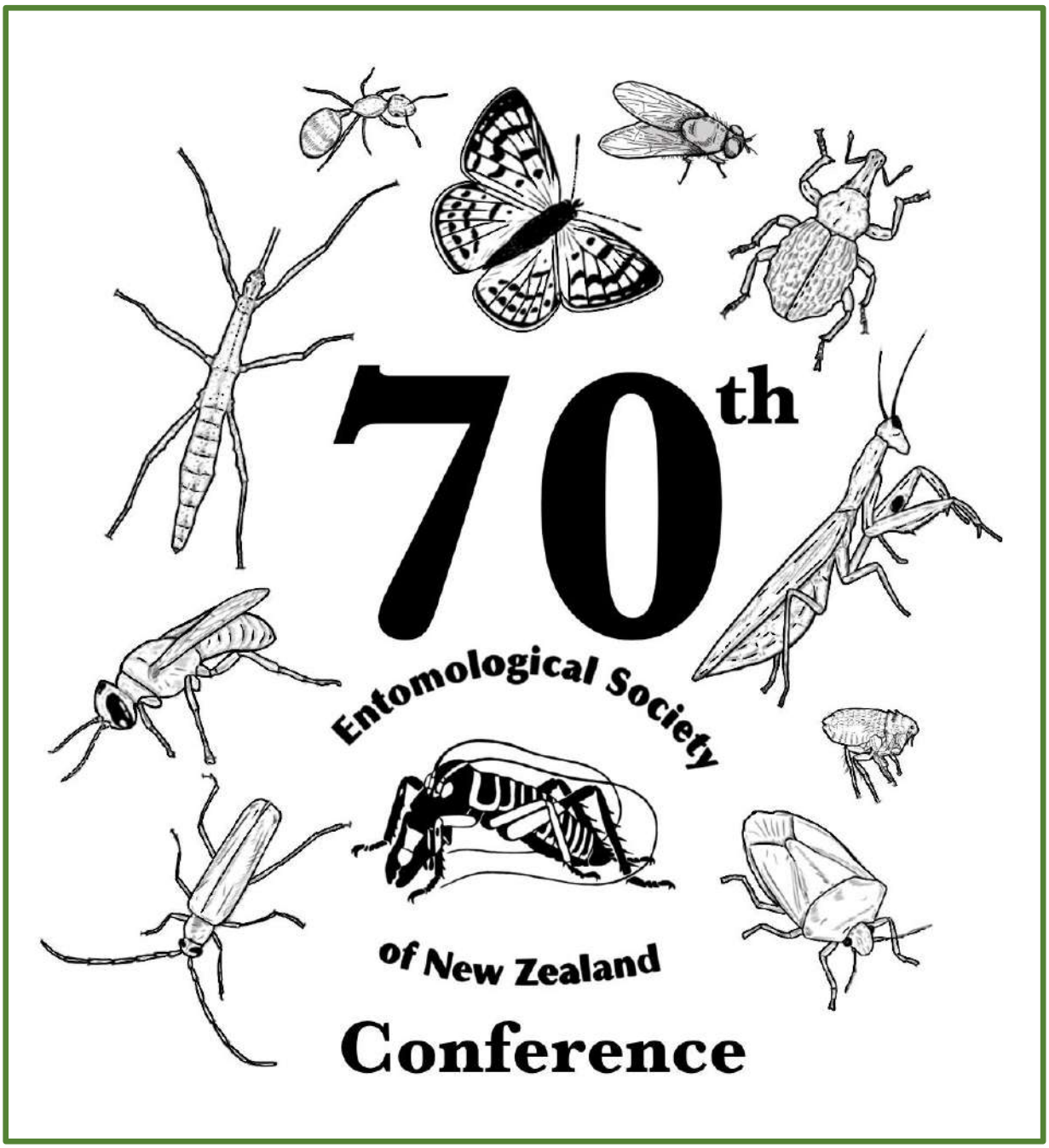


At the Novotel in Rotorua

26th to 28th October 2022

Kia ora!

We welcome you to the 70th annual conference of the Entomological Society of New Zealand, at the Novotel Rotorua. We have a full and exciting programme planned including a symposium dedicated to a discussion regarding insect curation and collection care. 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 that is particularly student friendly. We look forward to meeting each of you!

On behalf of the Society Executive and organisers,

Ngā mihi

Stephanie Sopow, Julia Kasper, Phil Sirvid, Rebecca Le Grice, Morgane Merien and Aaron Harmer

Information for delegates

The conference and most events will be at the Novotel Lakeside Rotorua, Tutanekai St, Rotorua.

Lunch is in the Novotel's Atlas Café.

Oral presentations

Please load your talks onto the presentation laptop as early as possible, prior to the beginning of the sessions. Presentation slots are 12 minutes (full talks) or 3 minutes (speed talks) plus question time. Please rehearse your presentation to ensure it stays within the allocated time.

Posters

Please place your posters on the poster boards provided outside the Rutherford Room during registration (Wednesday morning).

Thank you!

Programme Committee: Julia Kasper, Phil Sirvid, Rebecca Le Grice, Ang McGaughran, and Grace Mitchell.

Redwoods Treewalk are offering conference attendees a 20% discount.

Canopy Tours have offered members a 10% discount valid from Oct 20th 2022 to Oct 20th 2023. Please use the promocode INVERTEBRATEVIP when you book.

Dansey Reserve Night Walk: Bryce McQuillan and Carl Wardhaugh have offered a guided night walk of Dansey Reserve on Oct 25 (the day BEFORE the conference starts). This is limited to 20 people. please contact Bryce (info@brycephotography.co.nz) to reserve a place.

Public talk: Jacqui Knight

Cover Art: Morgane Merien

Rotorua Library for hosting the public talk and other insect activities

Plenary Speakers

Jacqui Knight

The “Butterfly Lady”, Jacqui Knight has dedicated almost 40 years to the protection of the monarch butterfly and NZ’s native butterflies and moths. In 2005 she started the Monarch Butterfly New Zealand Trust, which has morphed into the Moths and Butterflies of NZ Trust. “Our mission is to support education, fund research and advocate for the protection and restoration of New Zealand’s rich diversity of moths and butterflies.”

Public Talk Tuesday 15:30: “Monarchs and more”

Most people adore the monarch butterfly and want to know more about them. The monarchs are a wonderful ambassador for all of our invertebrates. Once you learn about how you can best help monarchs, you'll understand how important all our other insects are as well... and the part they play in our ecosystem. Come and hear from Jacqui Knight, founder of the Moths and Butterflies of NZ Trust and pick up tips how you can have a bounty of butterflies in your own garden.

Peter Dearden

Peter is a Professor at the University of Otago who is really an evolutionary developmental biologist whose career has been hijacked. Peter is Director of Genomics Aotearoa, Deputy Director of Bioprotection Aotearoa and science leader for the Future Bees programme.

Wednesday, 10:00: “Adventures in insect genomics”

The advent of genome sequences transformed our ability to study the biology of a small number of insects, but as the technology has improved it has become easier and easier to use genome data to rapidly probe the expression and function of genes, outside of traditional model system. In this talk I will explain how we use genome sequencing to understand insect biology, ranging from how embryos are made, how reproduction is controlled, to how biocontrol systems work.

Eric Edwards

For Te Papa Atawhai — DOC, am a Science Adviser for invertebrate conservation based in Wellington. In the last three decades my privilege included working in freshwater and terrestrial environments supporting efforts in survey, biosecurity and, ecosystem or species conservation. Often this is for invertebrates, with an interest in moths (even in my spare time).

Wednesday, 12:55: "Invertebrate's life - permission to research"

Ways to foster or influence conservation effort are a keen interest of mine and I am invested in how to engage about new technologies for wasps and a little differently, how communities and science can combine to retain anciently associated invertebrates and plants in their landscapes. And, not only because Te Papa Atawhai DOC’s resources are finite, it is essential to partner and enable many and varied researchers documenting and building knowledge of invertebrates.

Leilani Walker

Leilani Walker (Te Whakaōhea) is a lecturer in Environmental Sciences at Auckland University of Technology University, Auckland. Her interests include behavioural ecology and evolution of arachnids and equity in higher education.

Thursday, 9:00: "Lost children; scientific forays into Te Aitanga-a-Pēpeke"

Māori knowledge of te taiao has been of interest to Pākehā since first encounters although the motivations have changed over time. Using te-aitanga-pepeke as a focus, this talk will present a taxonomy of sorts of information about Māori relationships with insects, spiders and other invertebrate fauna. It will include anthropological texts written in English and niupepa Māori, and introduce pūrākau and whakapapa as methodologies for understanding the natural world.

Andrew Cridge

Andrew Cridge is a molecular entomologist with experience in biosecurity, biocontrol, insect genomics and genome evolution. His research focuses on developing integrated and sustainable solutions to detect and manage invasive insects in New Zealand's native and productive ecosystems. His current research centres on developing novel eDNA sampling and detection methods to improve terrestrial biosecurity monitoring. Andrew joined Scion in December 2020 as the Research Portfolio Leader for "Trees for High Volume Wood Products". Before moving to Rotorua, he was a Research Fellow at the University of Otago. He is a graduate of Lincoln University (BSc (Hons)) and Otago University (PhD).

Thursday, 13:15: "Biosecurity hide and seek"

Early identification of new invaders through extensive monitoring is the best approach if eradication is to be successful. Therefore, we need to develop new technologies that can help our biosecurity systems work smarter and faster to detect pests and diseases that pose threats to New Zealand's environment, economy and way of life. Here we describe recent research that has deployed environmental DNA (eDNA) techniques for biosecurity monitoring.

Lily Duval

Lily Duval is an artist, writer and researcher whose work is focused on insects and conservation.

Friday 9:00: "Insects in art"

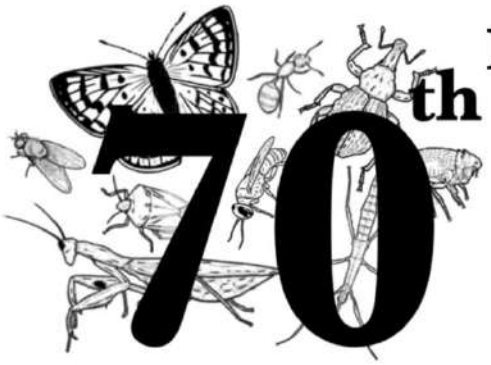
From the caves of our ancestors to high-status galleries in London and New York, the history of insects in art is rich and varied. Art offers us a way into the insect world. It can showcase their incredible beauty and diversity, create a sense of wonder in the person looking at it, and offer new perspectives on the animals. But if art has the power to connect us with the insects we share the world with, it can also do the opposite, rehashing ideas about insects as mechanical, alien, or invasive creepy crawlies. As we navigate the biodiversity crisis and the changing climate, how we represent insects and the stories we tell about them matters.

Wednesday 26th				
9:00	**Registration opens**			
9:15	**Morning tea**			
9:45	**Welcome**			
10:00	**GENES AND GENOMES**	**Key note Peter Dearden "Adventures in insect genomics"**		
10:45		Gracie	Kroos	Evaluating candidate genes for wing polymorphism and evidence for anthropogenic evolution in the stonefly *Zelandoperla fenestrata*
11:00		Dongmei	Li	DNA barcoding of ceratopogonid species
11:15		Paige	Matheson	The population genomics of pink bollworm, and assessing its biosecurity risk to Northern Australia
11:30		Graham	McCulloch	Melanism and mimicry: testing for human-driven shifts in NZ insect colour
11:45		Mateus	Detoni	Brain gene expression reveals limited caste differentiation between foragers and defenders in a social wasp
12:00	**Lunch in the Novotel's Atlas Café**			
12:55	**CONSERVATION**	**Key note Eric Edwards "Invertebrate's life - Permission to research"**		
13:40		Danilo	Hegg	The conservation status of giant wētā (*Deinacrida* spp.) in the South Island of New Zealand
13:55 **S**		Sheri	Johnson	Conservation of rare limestone plants: who are the pollinators?
14:00 **S**		Victoria	Smith	Niche modelling identifies low rainfall, but not soil type, as an important habitat requirement of the fossorial Australasian trapdoor spider genus *Cantuaria* (Hogg, 1902)
14:05		Ian	Henderson	How hard can it be to detect Global Insect Decline? Aquatic insects of Turitea Stream after 35 years
14:20		Joanna	Mackisack	Rearing ghosts: a novel method for the rearing and observation of *Aenetus virescens* (Lepidoptera: Hepialidae)
14:35		Tara	Murray	Seek and you might just find: Distribution of the threatened Tekapō ground wētā and evidence for a rapid response to the exclusion of hedgehogs
14:50	**ECOLOGY**	Jennifer	Jandt	The impact of floral complexity on bumble bee foraging in a semi-field environment
15:05		Aiden	Reason	Infectious fungi and civil engineering: factors influencing invasive paper wasp colony survival
15:20	**Afternoon tea**			
15:45		Priscilla	Wehi	Indigenous plant naming and experimentation: finding out more about tree wētā and their homes in New Zealand forests
16:00		Marius	van Staden	Using spiders as model species to investigate predator risk
16:15		Fabio Leonardo	Meza-Joya	Quaternary climates and volcanism explain patterns of intraspecific variation in grasshoppers endemic to Te Ika-a-Māui Aotearoa—North Island of New Zealand
16:30		Cassandra	Mark-Chan	The functional significance of rare wing pattern asymmetry in the North Island Lichen Moth.
16:45		Mari	Nakano	Antenna morphology and sexual signalling of three sympatric species of the New Zealand alpine grasshopper (Orthoptera: Acrididae: Catantopinae)
17:00		Greer	Sanger	Which nettle is best? Preference and performance of kahukura on native and introduced nettle in New Zealand.
17:15	**Poster session with cheese and wine**			
18:15	**Redwood walk (optional, please make your own booking using our discount)**			

Thursday 27th				
9:00	**Key note Leilani Walker "Lost children; scientific forays into Te Aitanga-a-Pēpeke"**			
9:45	**PHYSIOLOGY AND BEHAVIOUR**	Anne	Wignall	Tapping reduces aggression in the web-building spider *Pholcus phalangioides* (Araneae: Pholcidae)
10:00		Simon	Connolly	Monogyny and Introgression in New Zealand *Dolomedes*
10:15		Connal	McLean	Learning in bumble bees across environmental contexts
10:30		**Morning tea**		
11:00		Mike	Davy	Overcoming challenges to mate female *Eadya daenerys* (Braconidae) in the laboratory for biocontrol
11:15		Ashley	Mortensen	Person- er… 'bee-ality' of honey bee colonies
11:30 **S**		Keziah	D'Souza	To see or not to see: investigating the use of visual cues by *Pison spinolae*
11:35		Morgane	Merien	Evidence for direct oviposition into substrates by the New Zealand stick insect Spinotectarchus acornutus (Hutton 1899)
11:50		Kelly	Greig	Masters of camouflage; the function and evolution of debris adhesion in New Zealand Zopheridae beetles
12:05		Rebecca	Le Grice	Size variation, allometry and mating success in the hairy kelp fly (Coelopidae)
12:20	**Lunch in the Novotel's Atlas Café**			
13:15	**BIOSECURITY**	**Key note Andrew Cridge "Biosecurity hide and seek"**		
14:00		Josephine	McCambridge	The armoured scale *Oceanaspidiotus spinosus* (Hemiptera: Diaspididae) established in New Zealand
14:15		Manoharie	Sandanayaka	The invasive spotted lanternfly: insights from a visit to Pennsylvania State
14:30		Erin	Steed	The role of drone honey bees in dispersal of *Varroa destructor*
14:45		Andrew	Pugh	Trapping wood boring beetles during field investigations into the new invader *Xylosandrus crassiusculus* (Granulate Ambrosia Beetle) in Auckland
15:00 **S**		Melissa	Kirk	Colonisation and control success of weed biological control agents
15:05		Carl	Wardhaugh	Plantation forestry and biodiversity: how many beetle species can an exotic plantation forest support?
15:20	**Afternoon tea**			
15:45	**TAXONOMY**	Shaun	Thompson	A revision of New Zealand's Acroceridae
16:00		Luna	Thomas	Morphometrics and population differences in the Helm's stag beetle
16:15		Qing-Hai	Fan	Parasitic and phoretic mites of honeybees (*Apis mellifera*) from Wallis and Futuna
16:30		Kyle	Whorrall	Systematics and evolution of New Zealand debris-catching beetles (Coleoptera: Zopheridae)
16:45		Roanne	Sutherland	A new species of gall midge *Mycodiplosis constricta* found feeding on myrtle rust (*Austropuccinia psidi* i) in Aotearoa
17:00		Adam	Parkinson	Phylogenetic and morphological differentiation between subspecies of New Zealand red admiral butterfly (*Vanessa gonerilla*)
18:00	**Grab a bus**			
18:30	**Dinner at Te Puia**			
20:15	**Geyser tour**			
21:00	**Grab a bus**			

Friday 28th				
9:00		**Key note Lily Duval "Insects in art"**		
9:45		**Announcement of the BotY website**		
10:00	INNOVATIONS AND OUTREACH	Anton	Hovius	The New Zealand Mosquito Census: A three-year retrospective
10:15		Chrissie	Painting	The global spread of misinformation on spiders
10:30		**Morning tea**		
11:00		Stephen	Pawson	Developing new harmonic radar tools for tracking flying and terrestrial insects
11:15		Nimali	Suwandharathne	Predicting the current and future potential distribution of *Bactericera cockerelli*
11:30		Peter	Holder	Using isotopes to assess provenance of biosecurity risk insect pests: real world forensics
11:45		Samuel	Brown	Nutritional profiles of New Zealand invertebrate taxa for evaluating candidates for aquafeeds
12:00		**Lunch in the Novotel's Atlas Café**		
13:00		**Announcements, winners of awards**		
13:15	COLLECTION CARE	Julia	Kasper	The new storage project at Te Papa's entomological collection
13:30 **S**		Jiawei	Shen	Development of an online virtual plant pest reference collection – PHELdi (Plant Health and Environment Lab Diagnostic Images)
13:35 **S**		Emma	Burns	Digitisation of the Bulletins of Otago Museum
13:40		Johnathon	Ridden	A family affair, the Hitchings impact on the Canterbury Museum mayfly collection
13:55		**Curator's discussion panel**		
14:55		**Afternoon tea**		
15:25		**End of the Conference**		

S: Speed Talk



Entomological Society of New Zealand Conference

Abstract Book

(in chronological order)

10:45 Evaluating candidate genes for wing polymorphism and evidence for anthropogenic evolution in the stonefly *Zelandoperla fenestrata*

Kroos, G.C.[1], McCulloch, G.A.[1], Waters, J.M.[1]

[1]*University of Otago, Dept. of Zoology, 340 Great King Street, Dunedin North, Dunedin, New Zealand.*

email: krogr057@student.otago.ac.nz

Deforestation represents an extreme anthropogenic influence on terrestrial ecosystems globally. Notably, New Zealand has experienced extensive vegetation loss since human colonisation, with regions such as the Clutha Valley (Central Otago) now almost completely deforested. Previous research indicates that wing reduction in the wing polymorphic New Zealand stonefly assemblage *Zelandoperla fenestrata* (Family: Gripopterygidae, Subfamily: Zelandoperlinae) is tightly linked to the position of the alpine tree line. This association makes this species an ideal system to test the evolutionary impacts of recent deforestation.

We conducted extensive sampling across the Clutha Valley region to test for evidence of human-driven wing loss and applied genomic approaches to identify genes underpinning these rapid shifts in wing morphology. We found striking evidence of a morphological cline in wing reduction, with full-winged populations found in forested areas to the east, and completely wing-reduced populations in deforested regions to the west. Furthermore, we identified a likely wing-loss candidate gene in these populations. Our results suggest that repeated selection on standing genetic variation is prompting rapid evolutionary shifts in response to deforestation.

11:00 DNA barcoding of Ceratopogonid species

Li, D.[1], Belliss, G.[2], Boyd, B.[1], Chen, Y.[1], Maddison, P.[3], George, S.[1]

[1]*Plant Health and Environment Laboratory, Ministry for Primary Industries, PO Box 2095, Auckland 1140, New Zealand.*

email:dongmei.li@mpi.govt.nz

[2]*Associate Professor (Adjunct), Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin, NT, Australia.*

[3]*Research Associate, Landcare Research, Private Mail Bag 92170, Auckland Mail Centre, Auckland 1142.*

Ceratopogonidae are a family of ~6,000 species of small flies commonly known as biting midges. Several species of the genus *Culicoides* are economically important because they feed on livestock and transmit important diseases. *Culicoides* are not present in New Zealand, but their ability to disperse long distances over water has prompted an Arbovirus Surveillance Program in New Zealand, which involves placing traps in areas where *Culicoides* could establish to ensure their early detection. No *Culicoides*, but species of other genera, have been collected in these traps to date.

There are limited studies on the New Zealand Ceratopogonid fauna, with less than 40 species described, and this study aims to revise the taxonomy of the fauna using morphological and molecular techniques. Specimens were processed using a non-destructive DNA extraction, followed by analysis of mitochondrial COI, nuclear CAD and D2D3 regions of 28S genes, and morphological examination. Thus far, 151 individuals from New Zealand have been barcoded and 32 from Australia and 59 from the Pacific were also included for comparison. Analysis of the COI data suggests that 40 species from the genera *Atrichopogon, Dasyhelea, Forcipomyia, Leptoconops,* and *Paradasyhelea* are present, including a new record of an Australian species. CAD and D2D3 sequencing is currently being conducted to support the COI results and test the species limits of these genera.

11:15 The population genomics of pink bollworm, and assessing its biosecurity risk to Northern Australia – pre-recorded

Matheson, P.[1,2], McGaughran, A.[1]

[1]*Te Aka Mātuatua - School of Science, University of Waikato, Private Bag 3105, Hamilton 3240, New Zealand.*

email: paige.matheson14@gmail.com

The pink bollworm (*Pectinophora gossypiella*; PBW) is one of the most destructive pests of cotton. It has been managed for ~10 years using Bt (*Bacillus thuringienis*) incorporated cotton (transgenic cotton), which is toxic to caterpillars. However, some populations in India have evolved resistance against Bt, leading to widespread control failures. Recently, PBW has established a small population in Kununurra, Australia - posing a threat to the cotton industry there, especially if they are resistant to Bt.

My research aims to understand the population dynamics and invasion history of this cosmopolitan pest, and determine the likelihood that the recent Australian incursion is genetically connected to Bt-resistant populations. I achieve this by analysing genomic data in the form of SNPs obtained by DArTseq for populations in Australia, India, Pakistan, and America. Through various population genomic analyses (PCA, admixture, etc.), I discovered clear genetic structuring and very little mixing of populations between Asia, America, and Australia - suggesting that the Australian incursion did not originate from a known Bt-resistant strain. This information can advise PBW management plans in Australia, such as using transgenic cotton with refuge plants, and various other cultivation practices that improve the long-term durability of the biopesticide.

11:30 Melanism and mimicry: testing for human-driven shifts in NZ insect colour

McCulloch, G.A.[1], Foster, B.J.[1], Ni, S.[1], Waters, J.M.[1]

[1]*University of Otago*

Batesian mimicry – whereby a harmless species evolves to imitate the warning signals of a noxious species – has long fascinated biologists. Such mimicry likely shapes predation dynamics in New Zealand's forested ecosystems, with several stonefly species containing colour morphs that mimic the widespread noxious 'model' *Austroperla cyrene*, a species generally only found in forested streams.

We used genomic approaches to identify the genetic basis of mimicry in *Zelandoperla fenestrata*, and conducted extensive sampling to test the hypothesis that mimicry is restricted to forested regions where *A. cyrene* is abundant. We identified a mutation in the *ebony* gene linked to mimicry, with the same mutation apparently underpinning mimicry across the distribution of *Z. fenestrata*. Intriguingly, we found a strong association between mimicry and forests, with a striking absence of mimics in recently deforested regions. We propose that recent deforestation has resulted in widespread parallel reductions in 'model' abundance and mimic frequencies, potentially representing a world-class example of rapid anthropogenic evolution.

11:45 Brain gene expression reveals limited caste differentiation between foragers and defenders in a social wasp

Detoni, M.[1,2*], Dutoit, L.[1*], Dearden, P.K.[3], Harrop, T.W.R.[3,4], Ward, J.M.[1], Jandt, J.M[1].

[*]*Shared co-first authorship*

[1]*University of Otago, Dept. of Zoology, 340 Great King Street, Dunedin, New Zealand.*

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[2]*Manaaki Whenua – Landcare Research, Biocontrol and Molecular Ecology Team, 54 Gerald Street, Lincoln, New Zealand.*

[3]*University of Otago, Dept. of Biochemistry, 710 Cumberland Street, Dunedin, New Zealand.*

[4]*University of Melbourne, Faculty of Medicine, Dentistry and Health Sciences, 274 Grattan Street, Melbourne, Australia.*

The organisation of workers in behavioural castes occurs in most social insect societies. Behaviourally specialized individuals perform a set of tasks in the colony; younger, less aggressive workers perform in-nest tasks such as nursing, whereas older, more aggressive workers perform out-of-nest tasks such as foraging or defence. Genetic mechanisms have been suggested to explain variation in worker aggression across ecological contexts, yet few studies have focused on the role of gene expression in behavioural specialization during nest defence.

We compared the gene expression patterns in brains of nest defenders and foragers of the social wasp *Vespula vulgaris*, aiming to identify a transcriptomic basis for aggressive behaviour. By contrasting brain transcriptomes of defenders and foragers, we demonstrate weak differential gene expression between the two castes despite the phenotypic and transcriptomic differences observed across colonies.

We provide evidence for limited caste differentiation between out-of-nest workers in *V. vulgaris*, which aligns with the low genetic diversity within colonies and overall weak division of labour described for the species. We provide further discussion on the biological significance of the genes differentially expressed between foraging and defensive behavioural castes, and compare these results with previous investigations on the transcriptomic mechanisms underlying task partitioning in social insects.

13:40 The conservation status of giant wētā (*Deinacrida* spp.) in the South Island of New Zealand

Hegg, D.[1]

[1]*135 Blacks Road, Ōpoho, Dunedin, New Zealand*

email: danilo_hegg@hotmail.com

Seven species of giant wētā (genus *Deinacrida*) are known from the South Island of New Zealand. These are *Deinacrida carinata*, *D. connectens*, *D. elegans*, *D. parva*, *D. pluvialis*, *D. talpa* and *D. tibiospina*. In the 2014 NZTCS assessment of the conservation status of New Zealand Orthoptera, two of these species were assessed as Not Threatened, two were assessed as At Risk, Relict, and three as At Risk, Naturally Uncommon.

In preparation for the 2021 NZTCS assessment of the conservation status of New Zealand Orthoptera, I examined all available evidence on the population size and distribution for these seven species, and associated trends. I also conducted field surveys in historical hot-spots for all species. As a result of this work I recommend that only one species, *D. connectens*, should retain its low threat status.

Of the remaining six species, I recommend that one should be assessed as Threatened, Nationally Vulnerable, three as Threatened, Nationally Endangered, and two as Threatened, Nationally Critical. Here, I summarize the challenges faced by each species, as well as gaps in our knowledge of their ecology, and problems associated with their monitoring.

13:55 Conservation of rare limestone plants: who are the pollinators?

Milliken, S.[1], Lord, J.[2], Clement, Lagrue, C.[1,3], Johnson, S.[1]

[1]*Departments of Zoology, University of Otago*

email: sharnmilliken73@gmail.com

[2]*Department of Botany, University of Otago*

[3]*Department of Conservation*

The rapid decline of New Zealand's rare ecosystems is one of the main threats to biodiversity and ecosystem services. Plants endemic to these ecosystems are under immediate and severe threat from habitat loss. A part of designing efficient conservation strategies for threatened plant species is discovering how the species reproduces.

Many plants rely on cross-pollination for sexual reproduction, but most rare plant management approaches do not factor in pollination, or if they do, they do not identify the key pollinators. We are investigating the pollination of *Lepidium sisymbrioides* and *Gentianella calcis calcis*, two nationally critical plant species found in Otago limestone habitats, an ecosystem in severe decline.

We sampled from two sites in the Waitaki valley, North Otago. Observations of 10-minute increments per plant were conducted. Observed insects were caught, frozen and identified. Pollen was collected from each insect when present and compared to a pollen library of local plants. Results suggest that the main pollinator of *Lepidium sisymbrioides* was a species of *Leioproctus,* a native solitary bee.

The main pollinator for *Gentianella calcis* was *Melanostoma fasciatum,* a native hoverfly. Understanding the key pollinators is important for the assessment of the ecosystem as a whole. Affective management needs to include all aspects of a plant's ecosystem to truly conserve it, including their pollinators and the insect's specific habitats.

14:00 Niche modelling identifies low rainfall, but not soil type, as an important habitat requirement of the fossorial Australasian trapdoor spider genus *Cantuaria* (Hogg, 1902)

Smith V.R.[1], Vink C.J. [2], Fountain E.D. [3], Cruickshank R.H. [4], Paterson A.M [2]

[1] *Wildland Consultants Ltd., Middleton, Christchurch*
[2] *Department of Pest-management and Conservation, Lincoln University, Christchurch*
[3] *Peery Wildlife Ecology and Conservation Lab, Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, Madison, Wisconsin, USA*
[4] *Teaching and Administration, University of Canterbury, Christchurch*

Habitat loss is one of the greatest drivers for extinction worldwide. Understanding a taxon's habitat requirements is crucial in being able to protect it from decline. The Australasian trapdoor spider genus *Cantuaria* (Idiopidae) is widespread and diverse within the islands of New Zealand, but little is known of its ecology. We studied the habitat requirements of *Cantuaria*, using niche modelling, to inform conservation efforts and predict how the genus may fare under future climate conditions. Two data sets were employed. A fine-scale data set used hand-collected data from the vicinity of individual burrows for localised soil, vegetation, and human disturbance data directly inside and adjacent to *Cantuaria* populations. A spatial GIS data set at the landscape level mapped presence/absence of populations, as well as general environmental and soil conditions, and vegetation type. The two data sets were analysed separately, using linear models for the fine-scale data set (17 presences, 17 absences). General linear models were used to analyse the spatial data set (72 presences, 17 absences), with variables selected using a random forest analysis in R. In the fine-scale data set, no significant variables were found. In the spatial data set, rainfall explained most (71.4%) of the variation, according to the random forest analysis, followed by soil group (33.71%) and elevation (27.12%). Some variation was explained by more than one factor. The two models with the lowest AICC numbers included rainfall ($P < 0.01$) and elevation ($P = 0.06$), or rainfall only ($P < 0.01$), as variables. We conclude that low rainfall is desirable for populations of most *Cantuaria* spp., although some have been found where rainfall is up to 3000 mm/year. Climate change may cause challenges for *Cantuaria* conservation, particularly in areas with increased rainfall, such as Southland, Tasman, the West Coast, and Central Otago. Elevation and soil type may also be important factors in *Cantuaria* habitat selection, but further research with gene flow analysis, captive studies, more structured sampling, and/or a greater sample size may reveal more about the effects of elevation and soil type on *Cantuaria* populations.

14:05 How hard can it be to detect Global Insect Decline? Aquatic insects of Turitea Stream after 35 years

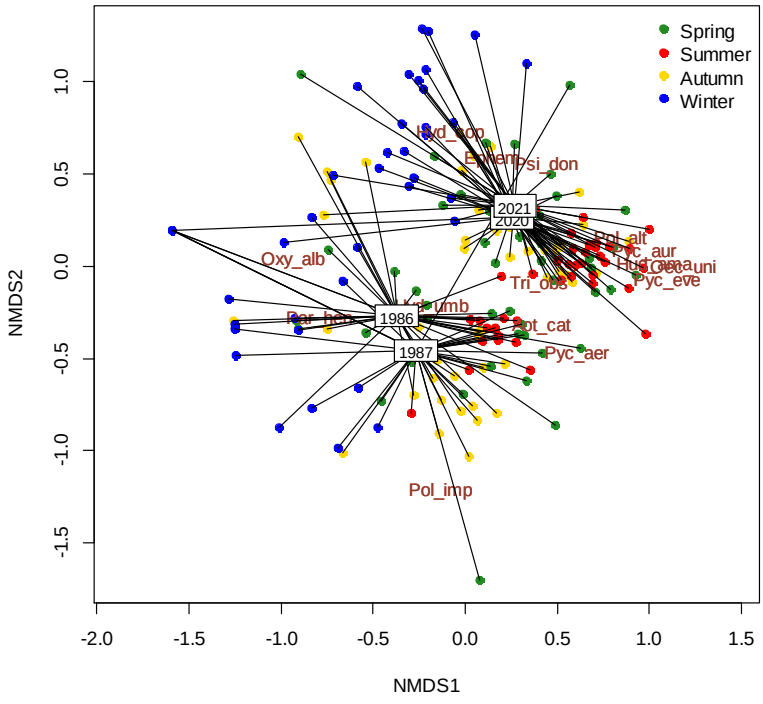
Henderson, I.M.[1]

[1]*92 Pahiatua St, Palmerston North, New Zealand. email:philorheithrus@gmail.com*

Insect populations are highly variable at multiple scales in space and time which makes detection of differences or trends challenging. Intensive light-trap sampling of selected aquatic insects in 1986-87 was repeated at the same location, using the same trap and protocols, in 2020-22.

Contrary to expectations, numbers of insects captured had more than doubled but this can largely be explained by the rise in air temperature which has a strong effect on insect flight activity. When air temperature is accounted for, there was no significant change in catch rate of overall numbers but there were significant increases and decreases in particular species. This change in community composition is indicative of an improvement in water/habitat quality - also unexpected given the peri-urban nature of the stream.

Methodological and statistical challenges for finding evidence for Global Insect Decline are explored, including the masking effect of climate change.



14:20 Rearing ghosts: a novel method for the rearing and observation of *Aenetus virescens* (Lepidoptera: Hepialidae)

Mackisack, J.L.[1]

[1] *Saint Johns, Auckland, New Zealand, email:mackisack.jo@gmail.com*

Adults of the pūriri moth/pepe tuna (*Aenetus virescens*) can be found throughout the North Island, however aspects of their life cycle are difficult to study. This is primarily due to larvae having a lengthy development time, difficult to accommodate feeding stages, and being inaccessible for observation during its tree-dwelling phase.

Background information on this charismatic species is presented, followed by the introduction of a novel approach to its rearing: radish (*Raphanus sativus*) utilised for the first time as a replacement for cambium tissue, enabling larval growth in dead wood. I share how eggs collected from a single specimen in 2021 have successfully reached 12th instar, with development ongoing. Regular photographic documentation and measurements of their head capsule give new insights into their growth rate and instar morphology - including the changeability of setal pinacula pigmentation. I also raise how mātauranga Māori has proved invaluable in procuring these observations, by informing the use of water to extract larvae from their tunnels - a traditional practice.

This method is exciting as it enables individuals to be reared long term, without reliance on live plant hosts. Knowledge gaps are highlighted and possibilities for future research are briefly explored.

14:35 Seek and you might just find: Distribution of the threatened Tekapō ground wētā and evidence for a rapid response to the exclusion of hedgehogs

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The ground wētā *Hemiandrus 'furoviarius'* has received little attention since its discovery in 1992. Thought to be restricted to the silty margins of the lower Tekapo river, it was classified as Nationally Critical, but several unpublished reports suggested it was more widespread. In 2019, DOC staff removing skinks from inside a predator-exclusion fence for the robust grasshopper discovered a healthy Tekapo wētā population. This prompted work to reassess the distribution and threat status of the wētā and determine any benefit provided by the fence. Baited live pitfall traps were set in PCL across the Mackenzie Basin. Another 467 traps were set at the predator-exclusion fence site, half inside and half outside the fence, and wētā were captured from November 2021 to January 2022. Wētā were detected at all but one site sampled from Omarama to the northern end of Lake Tekapo. At the predator fence, 4.8 times as many wētā were caught inside compared to outside the fence. We hypothesise that the greater abundance of wētā within the fence resulted from the exclusion of hedgehogs. Results suggest the Tekapō ground wētā is not as rare as previously thought, and its strong apparent response to predator exclusion may make it a good indicator of predation pressures on invertebrate communities across Mackenzie Basin drylands in the future.

14:50 The impact of floral complexity on bumble bee foraging in a semi-field environment

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The environment in which pollinators are reared may influence both their health and their pollination performance. We compared the performance of 12 colonies of bumble bees (*Bombus terrestris*), each in their own simple (tomato monoculture) or complex (tomatoes, borage, and lavender) environments inside a glasshouse. Foragers were observed daily to determine flower visitation rate to focal tomato plants, and fruit produced by those plants was weighed to determine pollinator effort. We found no evidence to suggest that adding floral resources to a tomato crop resulted in reduced crop yield. Moreover, colonies reared in complex environments had a higher proportion of foragers overall. These results provide an important step in understanding the extent to which bumble bee health and flower visiting behaviour is influenced by the complexity of the foraging environment, and how a complex floral environment may distract or enhance pollinator behaviour toward a focal crop plant (e.g., tomatoes).

15:05 Infectious fungi and civil engineering: factors influencing invasive paper wasp colony survival

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An invasive species and voracious predator of Aotearoa's native insect fauna, the Asian paper wasp (*Polistes chinensis*) is an important study species in the interests of invertebrate conservation. We examined paper wasp ecology, colony productivity, and survival rates on Farewell Spit Nature Reserve. Over two summer seasons, we surveyed colonies in the study area and monitored colony development weekly. Only ~20% of the colonies we followed each season survived until late summer, with high rates of colony mortality in late spring and early summer.

Two interesting and unexpected factors were found that may be influencing colony survival rates. First was fatal infection of wasps with entomopathogenic fungi species *Beauveria malawiensis* and *Ophiocordyceps humbertii*, the latter of which could potentially be adapted to manipulate wasp behaviour. Secondly, we observed a wasp behaviour of using paper-glue to brace the substrate nesting vegetation, effectively stabilising the nest in position. This behaviour may confer a survival advantage for colonies in the strong winds and harsh environment of Farewell Spit.

15:45 Indigenous plant naming and experimentation: Finding out more about tree wētā and their homes in New Zealand forests

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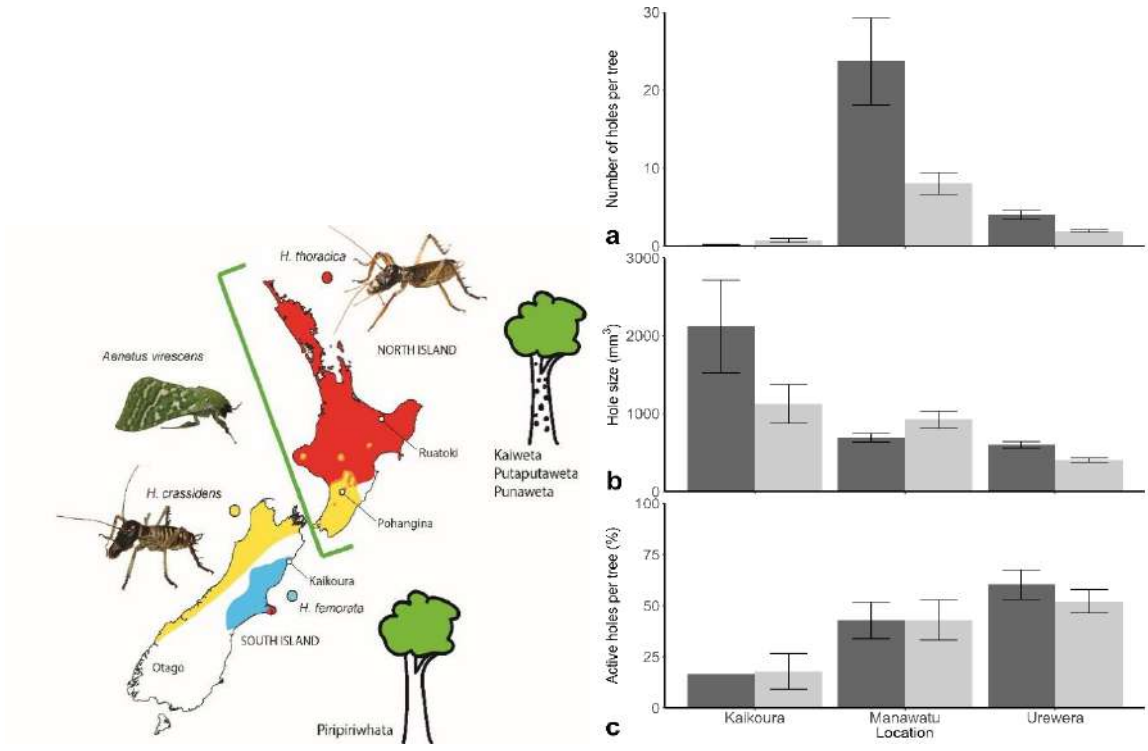
[3]*Massey University, Turitea Campus, Palmerston North, NZ*

What can Indigenous species names tell us about ecology? We drew from a "two-eyed seeing" approach to unpack mātauranga and conduct experiments, that together reveal ecological information about tree wētā and its host tree species in NZ forests.
We first examined Māori names for the common forest tree, *Carpodetus serratus*. These names suggest that close species interactions between the mostly herbivorous, hole-dwelling tree wētā and their host trees that might vary regionally. Our experiments showed consistent regional differences in the interactions between *Carpodetus* and tree wētā, that are mediated by the presence of a wood-boring moth species (*Aenetus virescens*). In regions with moths, *C. serratus* trees are home to more wētā than adjacent forest species, and these wētā readily ate *C. serratus* leaves, fruits and seeds. These findings confirm that a joint IK-experimental approach can stimulate new hypotheses and reveal spatially important ecological patterns.

We suggest that partnering with local holders of mātauranga to develop two-eyed seeing approaches that weave IK with quantitative data to assist planning and management can improve our understanding of NZ ecosystems.



16:00 Using spiders as model species to investigate predator risk

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All animals experience risk in some form or another, such as predation, lost foraging or lost reproductive opportunities. Research on risk and its mitigation is currently predominantly focused on prey species, however predators also experience risk. Examples of risks that predators may face include the risk of injury, loss of prey items or of becoming prey themselves. How predators assess and mitigate these risks can give us important insights into the outcomes of predator-prey interactions. My masters research will investigate the types of risks that predators face, and how they classify and mitigate these risks using spiders as a model species. Spiders are generalist predators with a diverse prey range. As a result, they face a wide range of risk types. Understanding risk assessment behaviour in predators will allow us to better understand predator-prey dynamics, and lead to insights into predator control and the use of predators as biocontrol agents.

16:15 Quaternary climates and volcanism explain patterns of intraspecific variation in grasshoppers endemic to Te Ika-a-Māui Aotearoa—North Island of New Zealand

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Cold-adapted biota inhabiting harsh environments provide opportunities to study natural and anthropogenic processes driving population structure and genetic diversity. Here, we combined mtDNA sequences, phenotypic traits, and niche modelling to investigate the influence of climate fluctuations and volcanism on the genetic and morphological structure of a wingless grasshopper *Sigaus piliferus*, endemic to North Island, New Zealand.

Genealogical relationships among ND2 haplotypes revealed a deep north-south split, similar to that observed in body size and pronotum shape, although they were only partially concordant. Demographic analyses depict a general situation of population stability at this species' range edges, with instances of demographic expansion elsewhere. Genetic signatures of isolation by distance suggest a once more connected species, likely during interglacials as inferred from niche models.

Pliocene land connection may explain presence in North Island of this sole representative of the endemic radiation. Environmental changes during the Pleistocene appear to have shaped current ranges and intraspecific variation in *S. piliferus*. Repeated volcanic-driven recolonisation was likely important in restructuring preexisting patterns of population differentiation and genetic diversity. We note that a decrease in suitable habitats for this species due to anthropogenic warming is likely to cause local extinctions and genetic impoverishment.

16:30 The functional significance of rare wing pattern asymmetry in the North Island lichen moth.

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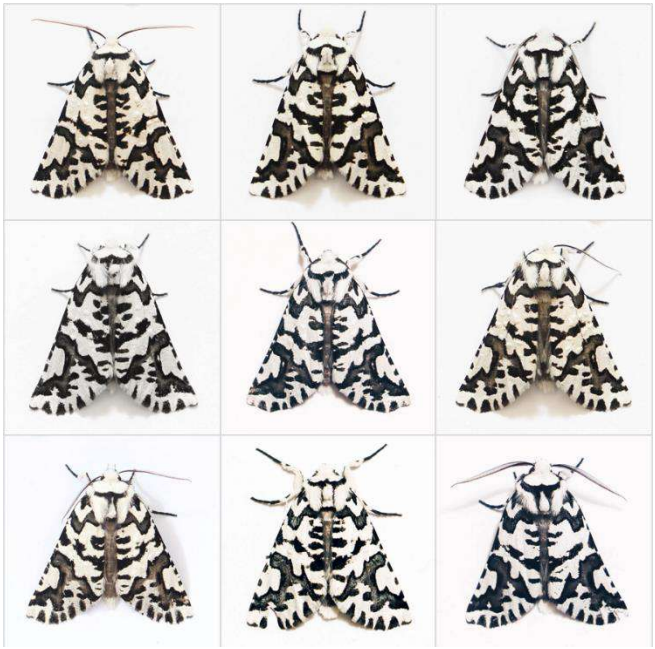
Bilateral symmetry is ubiquitous in the animal kingdom but presents a paradox for defensive camouflage as symmetrical patterns are a potent cue for visually searching predators. Most background substrates lack such symmetry; thus, the salience of symmetrical body features may enhance conspicuousness, imposing further survival costs for animals relying on camouflage. Theory suggests that cryptic prey may mitigate these costs by evolving body pattern asymmetry; however, animals with functional asymmetric body patterns appear to be rare in nature. The North Island lichen moth, *Declana atronivea*, may be an exception. This moth possesses intricate black and white forewing patterns that have been demonstrated to have an adaptive function for crypsis. Furthermore, the position, shape, and size of these colour patterns varies within and between individuals. I used geometric-morphometric analyses to quantify the level of wing pattern asymmetry and phenotypic variation in *D. atronivea*, and in-field predation experiments with artificial models to test whether asymmetric morphs have greater survival against avian predators than symmetric morphs. *Declana atronivea* were shown to possess pronounced asymmetry in wing pattern elements both within and between individuals. Furthermore, this asymmetry provided a significant survival advantage against predators in the field, suggesting that this trait may enhance the protective value of camouflage in this species.



16:45 Antenna morphology and sexual signalling of three sympatric species of the New Zealand alpine grasshopper (Orthoptera: Acrididae: Catantopinae)

Mari Nakano[1], Steve Trewick[1], Kye-Chung Park[2], Mary Morgan-Richards[1]

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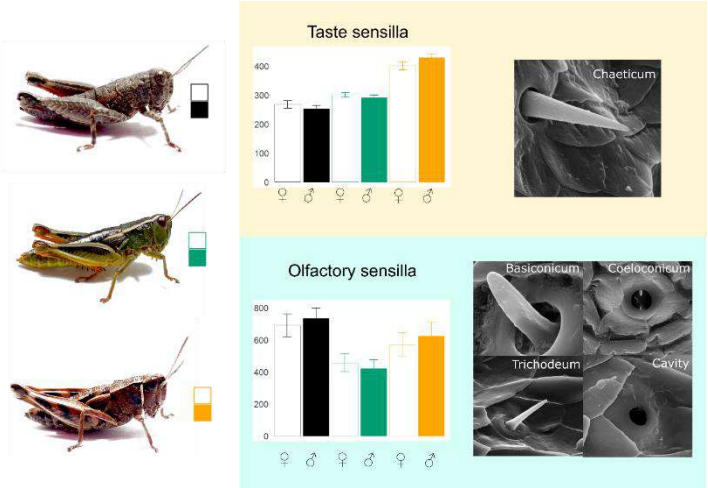
In some areas, multiple species co-exist without competitive exclusion. This is possible as the sympatric species are segregated in terms of habitat and food and possess species-specific mate recognition system. *Brachaspis nivalis*, *Sigaus australis* and *Paprides nitidus* are endemic New Zealand alpine grasshoppers which occur sympatrically in some regions of South Island, where they show preference for different substrates. *Brachaspis nivalis* is abundant on scree/rock habitat whereas *S. australis* and *P. nitidus* are found more on vegetated habitats.
As New Zealand alpine grasshoppers do not actively sing to attract mates, specific chemicals may be used to recognize their own species. The purpose of this study is to explore their communication systems by observing antenna sensilla (types, abundance and distribution) and identify species- and sex- specific chemical profiles. *Brachaspis nivalis* had significantly more olfactory sensilla but fewer taste sensilla than two other species, possibly related to their rock/scree habitat where food plants are sparsely distributed and threfore higher requirement on distance chemo-reception (i.e., olfaction) than contact (taste). No sxual difference was observed except in *S. australis*, where males had signicantly more olfactory sensilla than in females, potentially attributed to sexual selection on males to have high sensitivity to pheromones released by females. Three species showed chemical profiles that varied among species, and unexpectedly, females of all speices emitted sex-specific chemicals (oleamide and octadecanamide) possibly used for sex-recognition. Future study will explore behavioural and electrophysiological responses to smells for better understanding of their sexual signalling system.



17:00 Which nettle is best? Preference and performance of kahukura on native and introduced nettle in New Zealand.

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Kahukura (*Vanessa gonerilla*), also known as the New Zealand Red Admiral butterfly, is endemic to New Zealand. Kahukura are anecdotally in decline throughout the country, likely due to pesticide use and the removal of their host plant, the stinging nettle. New Zealand is home to 5 native and 4 introduced nettle plants. Our objective was to understand preference of ovipositing females and performance of developing larvae across three nettle species: NZ endemic Ongaonga (tree nettle, *Urtica ferox*), endemic Southern/Chatham Island nettle (*U. australis*) and introduced Dwarf nettle (*U. urens*). Kahukura adults were placed individually in a mesh cage for 4 hrs, with a nectar source and cuttings from the three nettle species. Once released the eggs were counted, taken back to the lab, and those that hatched were provided one of the three different nettle species throughout development. We found that adults preferred to lay eggs on endemic nettles (*U. ferox* and *U. australis*); no eggs were laid on introduced dwarf nettle (*U. urens*). The larvae reared on *U. australis* had the highest survival rate from egg to adult (50%) and pupal weight was highest among larvae raised on *U. ferox* (470 mg) and *U. australis* (340 mg) compared to *U. urens* (300 mg). We discuss the importance of planting and maintaining stinging nettle, especially Ongaonga and Southern/Chatham Island nettle to help our Kahukura populations thrive.

9:45 Tapping reduces aggression in the web-building spider *Pholcus phalangioides* (Araneae: Pholcidae)

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Web-building spiders are predators with typically poor vision, but they are excellent at detecting vibratory stimuli. Araneophagic predators such as assassin bugs and other spiders often adopt stealth and deceptive tactics to avoid eliciting dangerous aggressive responses in their spider prey. Paradoxically, assassin bugs tap their spider prey once they are within range of attack, leaving them vulnerable to counter-attacks. However, the spider prey do not respond aggressively to tapping. We tested whether tapping reduces aggression in web-building spiders in a controlled, repeated measures experiment by assessing the responses of spiders to simulated prey and comparing their responses after being tapped or sham-tapped. We demonstrate that tapping lowers aggressive responses in the web-building spider *Pholcus phalangioides* (Araneae: Pholcidae). We then tested how many taps are required to reduce aggressive responses in spider prey by presenting spiders with one, four, seven or ten taps and comparing their aggressive responses. We propose that assassin bugs are tapping into a phylogenetically conserved mechanism to reduce mis-directed aggression in web-building spiders.

10:00 Monogyny and introgression in New Zealand *Dolomedes*

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Monogyny is the mating system whereby males will only mate with one female in their lifetime. Spiders are often used as a study group for the evolution of monogyny. In spiders, monogyny is associated with sexual cannibalism, genital damage, male-biased sex ratios, protandry and female-biased sexual size dimorphism. The exact causal relationship of these factors is unclear. Related to mating behaviour is introgression, the movement of genes from one species to another. My research addresses two major gaps in our understanding of monogyny evolution and introgression, by 1) comparing the mating systems and mating system elements of closely related spider species, and 2) investigating how mating systems can both facilitate and limit 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*. Whilst study on these species has been limited, evidence suggests that *D. aquaticus* is polygynous (males will mate with multiple females) and *D. minor* is monogynous. Additionally, there is a one-way introgression between the two species, which is also geographically restricted.

10:15 Learning and body size in bumble bees (*Bombus terrestris*) across environmental contexts

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Floral species biodiversity is associated with pollinator health and performance at the colony and individual level. Within a colony, individual bumble bees vary substantially in body size, where larger individuals are more likely to forage, and tend to have higher cognitive abilities, whereas smaller bees tend to remain in the nest and engage in brood care. Within-colony size variation is determined by larval nutrition. Biodiversity and richness of the floral landscape in which bumble bees live affects the diversity of pollen and nectar rewards a forager can bring to the nest, which determines diet of developing brood. Using a Free-Moving Proboscis Extension Response protocol, we tested associative learning in 160 bees from eight colonies with access to environments with either high or low flower species diversity. Among those bees that successfully learned to associate an olfactory cue with a reward, we conducted reversal learning assays. While there was no difference in learning capacity among individuals that had access to high or low floral diversity, colonies from high floral diversity produced larger workers. This study is one of the first to show how colony development and learning is affected by environmental complexity using bumble bee foragers raised in controlled environments with naturally blooming floral resources.

11:00 Overcoming challenges to mate female *Eadya daenerys* (Braconidae) in the laboratory for biocontrol

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The parasitoid *Eadya daenerys* (Braconidae) has been approved for release in New Zealand to control the Eucalyptus tortoise beetle *Paropsis charybdis* Stål (Chrysomelidae), a defoliator of Symphyomyrtus eucalypts (such as *Eucalyptus nitens* Maiden; Myrtaceae) which are grown for forestry. Prior to release, the parasitoid will be mass-reared in Scion's containment facility to produce thousands of offspring, enough for the establishment of minimum viable populations upon release at several sites across New Zealand.

As is common for parasitoids, unmated females produce only male offspring, whereas mated females can produce either male or female offspring. Consequently, mating enough females with males is an essential step in the release process to ensure the production of sufficient male and female offspring to sustain future generations. However, *E. daenerys* has been particularly difficult to mate in a laboratory setting in previous years, having only two observed mating events over five years.

Several methods have been attempted to increase mating success, including chilling the females, increasing the number of males in the mating chamber, using different aged females, and even playing them a bit of music. Of the various methods trialled, female age has proven to be the most useful.

11:15 Person- er… 'bee-ality' of honey bee colonies

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Personality influences how we interact with and respond to the world around us. Similarly, 'personality' (consistent behavioural patterns of an individual over time and across situations) can affect how honey bee colonies respond to their environment. We assessed foraging behaviour in 64 honey bee colonies in response to each of four supplemental feeding treatments. We quantified colony investment in pollen and non-pollen foraging before and for each of 3 days following treatment. Behaviour patterns of colonies were highlighted by the degree of responsiveness, with some colonies consistently modifying their foraging investments in response to treatments while others had practically no change in foraging investment following treatments.

11:30 To see or not to see: investigating the use of visual cues by *Pison spinolae*

D'Souza, K.[1,2]

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[2]*Auckland War Memorial Museum Tāmaki Paenga Hira, Auckland, New Zealand*
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Predator-prey interactions are mediated by an animal's sensory system. Species vary in their perception of their environments, including being limited by their abilities to visually recognise and discriminate prey from non-prey. *Pison spinolae* (Crabronidae) is an orb-web spider hunting parasitoid; being able to detect the spider prey and webs is crucial for its hunting strategy. This study investigated whether *P. spinolae* uses visual cues to recognise prey species at close range, using chromatic vision. Prey and non-prey spiders (fresh, museum specimens and nest specimens) were spectrally analysed and modelled into a Crabronidae visual system. General linear models compared prey and non-prey spiders, assessing *P. spinolae*'s ability to detect and recognise prey. Though all spiders were discernible against natural backgrounds (JND values all > 1), *P. spinolae* likely cannot visually discern between prey and non-prey. The use of achromatic vs. chromatic vision, spectral differences by collection method and evidence of alternate cue use in prey detection is discussed.

11:35 Evidence for direct oviposition into substrates by the New Zealand stick insect *Spinotectarchus acornutus* (Hutton 1899)

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Rō | Stick insects (Phasmatodea) have many different oviposition strategies, often reflecting a range of adaptive behaviours and morphologies to best place eggs in their environments. Oviposition strategies in Aotearoa | New Zealand phasmids are not well documented, but the literature so far suggests that they drop individual eggs to the ground from their position in the foliage. Here, we present a newly observed oviposition strategy in *Spinotectarchus acornutus*, an endemic stick insect from Aotearoa | New Zealand. Individual female *S. acornutus* were observed inserting their eggs in a range of substrates, in particular the bark of trees and in spaces within the textured surfaces of tree fern trunks. In doing so, we highlight how the specific morphology of their eggs may be an adaptation to help attach to substrates, while their elongated operculum could aid in egg insertion into substrates.

11:50 Masters of camouflage; the function and evolution of debris adhesion in New Zealand Zopheridae beetles

Greig, K. J.[1,2]

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Camouflage is one of the most common evolutionary defences utilized by prey species to avoid predation. Camouflage strategies are numerous and diverse but one of interest is a technique that falls under many names: decorating, trash carrying, debris carrying, and soil crypsis to name a few. These terms describe a strategy seen in some species, where they collect debris and environmental fragments to attach to their exoskeletons, either actively or passively. Though thought as a form of crypsis and/or physical protection, the adaptive significance of debris collection strategies has not yet been tested via behavioural experimentation and may function as background matching, chemical camouflage, or something else entirely. A potential model group for the further investigation of passive debris collection strategies is a group of ancient saproxylic beetles known as Zopheridae. Zopherids are highly diverse in the New Zealand fauna and display rich cuticle variation in the form of ridges, bumps, and cavities as well as a variety of scales and setae. Many genera display a passive debris adhesion adaptation sometimes referred to as encrustations. These encrustations potentially act as a multifunctional form of camouflage, protecting the beetles from both visually oriented and chemically reliant predators.

12:05 Size variation, allometry and mating success in the hairy kelp fly (Coelopidae)

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[1] *University of Auckland, School of Biological Sciences, Auckland, New Zealand*

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The need to respond quickly to the presence of an ephemeral resource required for breeding is often a feature of scramble competition mating systems. Scramble competition mating systems can feature extreme levels of sexual conflict and coercive mating by males. As a result, sexual selection can act on various traits used by males to overcome female resistance behaviours. Selection on these traits may result in significant intra and intersexual size variation and sexual dimorphism. Additionally, traits that influence mating success in males often show positive static allometry. Kelp flies (Coelopidae) are a small family of Diptera which specialise on wrack (beach cast marine macroalgae), a highly ephemeral resource. The mating system of these flies involves high levels of sexual conflict, with females rejecting all male mating attempts. Here we describe intra and intersexual size variation and static allometry of traits in *Chaetocoelopa littoralis*. In addition, we investigate their mating behaviour under ecologically relevant mating conditions. We found high levels of size variation and significant evidence of sexual dimorphism across all traits measured. Furthermore, we found that larger male *C. littoralis* which attempt to mate are significantly more likely to mate successfully demonstrating a large-size advantage.

13:15 Biosecurity hide and seek

Cridge, A.G [1], Hyink, O.[2], Armstrong, K.F. [3], Harrop, T.W.R. [2], Wardhaugh, C.[1] Dearden, P.K [2]

[1] *Scion, New Zealand.*
[2] *Laboratory for Evolution and Development, Department of Biochemistry, University of Otago, Dunedin, New Zealand.*
[3] *Bio-Protection Research Centre, Lincoln University, Lincoln, New Zealand.*

Biosecurity monitoring protects New Zealand from the invasion of harmful organisms. Recent insect, plant and disease incursions in New Zealand have highlighted that once new invaders have crossed into the country, they are difficult to contain and require comprehensive resources to monitor and control. Early identification of new invaders through extensive monitoring is the best approach if eradication is to be successful. Therefore, we need to develop new technologies that can help our biosecurity systems work smarter and faster to detect pests and diseases that pose threats to New Zealand's environment, economy and way of life. Here we describe recent research that has deployed environmental DNA (eDNA) techniques for biosecurity monitoring. Including research that used honeybees (*Apis mellifera*) to collect pollen from monitoring sites across New Zealand and applied eDNA techniques to classify the pollen collected to identify the invasion and spread of noxious plant species. As well as highlighting research that uses remote insect trapping to collect insects at high-risk sites and uses eDNA to identify the insect collected. Both approaches were evaluated to determine the feasibility of using these in large-scale integrated biosecurity monitoring networks.

14:00 The armoured scale *Oceanaspidiotus spinosus* (Hemiptera: Diaspididae) established in New Zealand

McCambridge, J. E.[1]

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The armoured scale insect *Oceanaspidiotus spinosus* (Comstock 1883) (Hemiptera: Diaspididae) was found on kiwifruit from the Bay of Plenty and Gisborne in 2019. These were the first records of this species from New Zealand. Prior to 2019, only three species had been found on kiwifruit: *Hemiberlesia lataniae*, *Hemiberlesia rapax* and *Aspidiotus nerii*. During the subsequent 2020-2022 kiwifruit export seasons, *O. spinosus* continued to be recorded in these regions, including in new orchard locations. Furthermore, it has now been recorded in Northland and Hawkes Bay, two completely new regions. These new regions represent the new northernmost and southernmost records in New Zealand. *O. spinosus* is a polyphagous pest, and globally has also been recorded on avocado, citrus, apple, and blueberry. The proximity of infested kiwifruit orchards to orchards with other potential host crops may have implications in New Zealand for *O. spinosus* spreading to new hosts.

14:15 The invasive spotted lanternfly: insights from a visit to Pennsylvania State

Sandanayaka, W.R.M.[1], Todd, J.H. [1]

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The spotted lanternfly (SLF, *Lycorma delicatula*) is an invasive insect causing economic losses in fruit and wood production. It has become a global biosecurity threat following invasions into many countries with suitable environments for its establishment. Understanding the potential seasonal life history and survival of this pest in its invasive range can inform monitoring programmes, which is a key step in biosecurity preparedness. In the United States (US), SLF was first discovered in Berks County, Pennsylvania, in September 2014 and has since spread to other counties in Pennsylvania and neighbouring states. This paper describes the knowledge and experience gained on SLF host preferences and on applications of effective management programmes to control SLF during our visit to Pennsylvania State in September 2022. Our study has focused on assessing the impacts of SLF on US industries and ecological areas. We have also contributed to ongoing electropenetrography monitoring of SLF feeding on selected New Zealand (NZ) native and crop plants. Our US findings are likely to be of interest to NZ horticultural industries and growers in the potential SLF host range and will help to minimise the efforts and expenses required for managing this critical pest if it arrives in NZ.

14:30 The role of drone honey bees in dispersal of *Varroa destructor*

Smith, J.B[1], Clancy, T.B.[2] Steed[1], E., Painting[2], C., J.P.[1] & Mortensen, A.N[1]

[1]*Bee Biology & Productivity Team, The New Zealand Institute for Plant and Food Research Limited*

[2]*Te Aka Mātuatua School of Science, University of Waikato, Hamilton, New Zealand*

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Honey bee mating sites, known as drone congregation areas (DCAs), are areas where drones (male honey bees) from colonies in the surrounding area gather in large numbers to mate with queen honey bees. Preliminary work has demonstrated a potential correlation between the prevalence of *Varroa destructor* on drones at DCAs and the *V. destructor* infestation rates of nearby managed colonies. We have expanded theses data to further our understanding of the relationship between *Varroa* infestation rates at mating sites and nearby managed colonies. Furthermore, we evaluated varroa preferences between adult honey bee castes in laboratory choice tests. We will highlight future directions and potential applications of these data.

14:45 Trapping wood boring beetles during field investigations into the new invader *Xylosandrus crassiusculus* (Granulate Ambrosia Beetle) in Auckland

Withers, T.M.[1], Meurisse, N.M.[1] Sutherland, R.[1,2], Pugh, A.R.[1] Kerr, J.[1], Ranger, C. M.[3], Reding, M. E.[3]

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[2]*Current address: Department of Conservation, Te Papa Atawhai, 253 Chadwick Rd, West Greerton, Tauranga 3112, New Zealand. email: rsutherland@doc.govt.nz*

[3]*USDA-Agricultural Research Service, Horticultural Insects Research Laboratory, 1680 Madison Ave., Wooster, Ohio, 44691, USA*

Xylosandrus crassiusculus (Coleoptera: Curculionidae) was first detected in New Zealand in 2019. Flight intercept traps baited with ethanol lures were deployed at three sites in the Auckland region. They were baited with ethanol lures with three different release rates. We also deployed ethanol-soaked or non-soaked wood bolts from three species of known host trees.

There was a positive correlation between ethanol release rate and trap captures of GAB which concurs with results observed on other *Xylosandrus* species in overseas studies. The flight intercept traps baited with a lure with a perforated hole that released 2 g/day was most effective at capturing GAB.

Non-ethanol soaked wood bolts were never attacked. Ethanol-soaked bolts were less effective than the flight intercept traps with ethanol lures, all species of wood bolt were attacked by GAB. The soaked wood bolts also attracted two other species of invasive pin hole borer, *Xyleborinus saxesenii*, detected in NZ since 1961, and *Microperus eucalypticus*, detected in NZ since 1975. Females of these species were found establishing galleries in the ethanol-soaked wood bolts generally later in the season. Invasive borers could have serious impacts on trees in New Zealand.

15:50 Colonisation and control success of weed biological control agents

Kirk, M.[1,]

[1]*Auckland War Memorial Museum, Dept. of Natural Sciences (Entomology). Auckland Domain, Parnell, Auckland 1010. email:mkirk@aucklandmuseum.com*

Weeds are economic, social, and environmental pests. Biological control agents (BCAs), found largely from the class insecta, and are natural enemies of weeds. BCAs are deliberately released to control a target weed's growth, density, and population size. The success of BCAs is highly variable. The aim of this study is to explore factors effecting the success of BCAs.

I used data from a catalogue of worldwide weed control programs and supplemented this with further literature searches. This study explored how founding population size, number of releases, number of release sites, the timing of BCAs (time separation between weed and agent), number of colony populations sourced, number of pathways before release (bridgehead population effect), life history traits of weeds (reproductive form, life cycle, ecosystem type), and feeding guild types, affect both the establishment of agents and control by agents.

This study found that the success of the control agents was affected by many factors such as population agent dynamics, release dynamics of agents, and weed life history traits. This study highlights the importance of some ‘overlooked’ factors that influence the establishment and control level of weed BCAs, and thus can consequently impact the release protocols of agents.

15:25 Plantation forestry and biodiversity: how many beetle species can an exotic plantation forest support?

Wardhaugh, C.A., Bryers, T.

Scion, New Zealand Forest Research Institute, Titokorangi Drive, Rotorua

email: carl.wardhaugh@scionresearch.com

Exotic plantations are in general considered to support very little biodiversity compared to natural indigenous forest. However, there exists sporadic evidence that exotic pine plantations in New Zealand can support a wide variety of indigenous forest species. In this study we examined the entire beetle community collected from canopy and ground-based traps to quantify the role exotic pine plantations can play in supporting biodiversity compared to native forest. Furthermore, by examining a chronosequence of 2nd and 3rd rotation stands, we examined whether diversity is declining over time in plantations. Overall, we collected 9,338 beetles from 557 species across 15 pine and native forest sites. While beetle diversity was highest in native forest, we found that exotic pine plantations supported ~65-70% of the number of beetle species from native forest sites. The vast majority of beetle species and individuals collected were endemic, with only 34/557 beetle species confirmed as introduced across all forest types, and there was no difference between exotic plantations and native forest in the proportions of native and exotic beetle species or individuals. Interestingly, we did not find any decline in beetle diversity or abundance between 2nd and 3rd rotation pine stands, indicating that the beetle community is able to quickly recolonise these sites as the new plantation matures. Our data refute the widespread generalisation that all exotic plantations are incapable of supporting many indigenous species, and show that those in New Zealand at least, could play a substantial role in supporting biodiversity and associated ecosystem functions as they undoubtedly support more indigenous biodiversity than any other production crop.

15:45 A revision of New Zealand's Acroceridae

Thompson, S.A.[1,2], Vink, C.[2], Kasper, J.[1] , Sirvid, P.J.

[1]*Museum of Te Papa Tongawera, 169 Tory Street, Te Aro, Wellington, New Zealand.*

[2]*Lincoln University, 1467 Spring Road, Lincoln, New Zealand*

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The cosmopolitan family Acroceridae, also known as small headed flies, are a group of Diptera whose larvae are endoparasitoids of spiders and are naturally uncommon in New Zealand. Beyond that, the biology of this group is poorly understood. Within New Zealand, three genera occur: *Ogcodes*, *Helle* and *Apsona*, but the taxonomy of this group is outdated. This study aims to provide a taxonomic revision of the family Acroceridae within New Zealand. Additionally, the distribution and biology of the group will be investigated, with an emphasis on identifying host species. Collection data and specimens from museums will be utilised and flies will be collected from the field. A combination of molecular and morphological methods will be used to build phylogenetic trees for each genus, examine the taxonomy of these groups and identify potential new species.

16:00 Morphometrics and population differences in the Helm's stag beetle

Thomas, L.[1], McCulloch, G.[1], Trewick, S. A. [2] & Johnson, S. [1]

[1] *Department of Zoology, University of Otago, Dunedin.*

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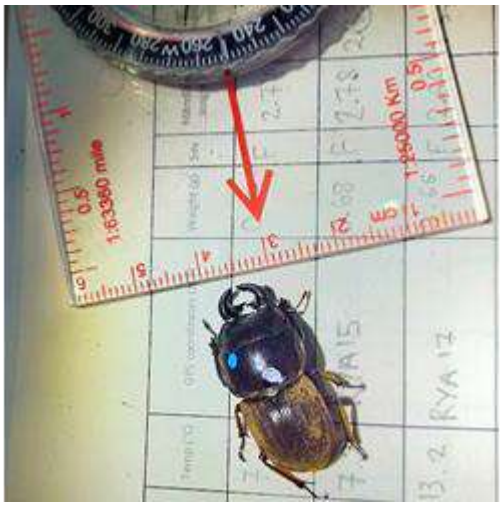
New Zealand is home to many endemic beetles, one of the largest of which are the stag beetles, including the impressive *Geodorcus* stag beetles. The genus includes ten species of large flightless beetles. Most of the species have restricted ranges, with the exception of *G. helmsi*, which is widespread on the South Island, with a reported range from Stewart Island in Southland up to Karamea in Westland. The wide geographic range even though the beetles are flightless suggests that the species was at one time very abundant and had good gene flow among populations. Alternatively, this taxon might include cryptic, reproductively separate species. Preliminary genetic evidence is consistent with this, displaying 8% divergence between Southland/Otago and West Coast populations. We tested whether this genetic divergence has led to differences in morphology. We measured beetles from entomological collections and from 10 wild populations and used allometric analyses to determine whether there is a morphological difference between populations. We found that beetles in West Coast populations are significantly smaller than beetles in Southland. Overall, our findings suggest that there is some evidence of cryptic speciation along the range of *G. helmsi*, and we are currently evaluating this hypothesis using genomic approaches.



Male Geodocus helmsi on Stewart Island. Photo by Melita Busch

16:15 Parasitic and phoretic mites of honeybees (*Apis mellifera*) from Wallis and Futuna

Fan, Q.H.[1], Camoin, C.[2]

[1] *Plant Health and Environment Laboratory, Ministry for Primary Industries, Auckland, New Zealand.*

[2] *Centre d'Apiculture & Réseau d'épidémiosurveillance Apicole (RESA), Nouvelle Calédonie.*

email: QingHai.Fan@mpi.govt.nz

This is the first report of parasitic and phoretic mites on honeybee (*Apis mellifera*) from the South Pacific islands, Wallis and Futuna. Seventy-eight samples containing 8415 bees (including 7973 workers and 442 drones) were washed for external mites and thirty worker bees from each sample were tested with the thoracic disc method (TDM) for internal mites. All samples tested were negative for the major honeybee parasites, *Acarapis woodi*, *Tropilaelaps* spp. and *Varroa* spp. The mites detected, 297 individuals, were mounted on microscope slides. Eleven species were identified, and all are new to the fauna of Wallis and Futuna. *Acarapis dorsalis* (57.69%, family Tarsonemidae) is the most common species, followed by *Suidasia pontifical* (20.51%, Suidasiidae), *Hattena tongana* (11.54%, Ameroseiidae), *Tyrophagus javensis* (10.26, Acaridae), *Afrocypholaelaps africana* (7.69%, Ameroseiidae), *Acarapis externus* (2.56%, Tarsonemidae), and *Chaetodactylus ludwigi* (2.56%, Chaetodactylidae). Four other species, *Brevipalpus obovatus* (Tenuipalpidae), *Cheletomimus bakeri* (Cheyletidae), *Tyrophagus communis* (Acaridae) and *Tyrophagus macfarlanei* (Acaridae) were detected on only one occasion. Apart from these, seven species were not identified beyond genus level, *Cerophagopsis* sp. and *Thyreophagus* sp. (Acaridae), *Czenspinskia* sp. and *Vidia* sp. (Winterschmidtiidae), *Grallacheles* sp. (Cheyletidae), *Lipstorpia* sp. (Histiostomatidae), and *Tenuipalpus* sp. (Tenuipalpidae).

16:30 Systematics and evolution of New Zealand debris-catching beetles (Coleoptera: Zopheridae)

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At around 200 native species, Zopheridae are the fourth most species-rich beetle family in New Zealand, yet the relationships between taxa are still poorly understood. Recent analysis of the CO1 and 28S genes has confirmed the need for revision of multiple genera. I seek to provide greater resolution of the relationships between taxa by constructing a dataset from ultraconserved elements (UCEs). I have concentrated particularly on revising the endemic genus *Heterargus* for use as a focal group to answer evolutionary questions. I am using biogeographic analysis to trace back the history of dispersal within New Zealand by *Heterargus* and between New Zealand, Australia, and New Caledonia by the family at large. In each zopherid species, the surface of the body is covered in a different assortment of tubercles, punctures, and setal forms. The complex structure traps exudates produced by the beetle as well as environmental debris, resulting in a layer of encrustation which obscures the cuticular surface. Using a character set developed for the traits which enable debris capture, I am performing ancestral state analysis to assess the diversification of debris capture morphology.

16:45 A new species of gall midge *Mycodiplosis constricta* found feeding on myrtle rust (*Austropuccinia psidii*) in Aotearoa

Sutherland, R.[1,2], Pugh, A.R[1], Kolesik, P[3] & Withers, T.M.[1]

[1]*Scion, New Zealand Forestry Research Institute, Dept. of Entomology, Titokorangi Drive, Whakarewarewa, Rotorua, New Zealand.*
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[3]*South Australian Museum, Adelaide, Australia.*

email: rsutherland@doc.govt.nz

Austropuccinia psidii the causal agent of myrtle rust was first detected in Aotearoa in 2017 and has now spread across most of the predicted climatic range in Te Ika-a-Māui (North Island) and parts of Te Waipounamu (South Island). Myrtle rust is a serious fungal disease that is causing localised dieback and death of some of the most susceptible native Myrtaceae species. While undertaking disease assessments at field sites in Rotorua, some minute gall midge larvae were observed feeding on myrtle rust spores in 2018. Using gene sequencing the larvae was identified to be in the dipteran family Cecidomyiidae and later confirmed through morphological traits to be in the tribe Mycodiplosini. Rearing techniques were trailed in the lab with some success and then the morphology of male and female flies, pupae, and larvae have since been described and the COI gene sequenced. This is the first described *Mycodiplosis* recorded in Aotearoa and its current full distribution is unknown. Larvae have been recorded at other field sites in Taranaki and Auckland regions, but not confirmed as the same species. To understand more about the distribution and feeding habits of this tiny gall midge, historical herbarium records have been examined.

17:00 Phylogenetic and morphological differentiation between subspecies of New Zealand red admiral butterfly (*Vanessa gonerilla*)

Parkinson, A.A., Wells, S.J.

Unitec Institute of Technology, School of Environmental and Animal Science, Private Bag 92025, Victoria St West, Auckland 1125, New Zealand

email: aparkinson@unitec.ac.nz

Subspecies are taxonomic units used to formally describe intraspecific geographic variation in morphological markers, yet without thorough assessment, these morphological markers can be highly subjective. The accepted demarcation of *Vanessa gonerilla* is *V. gonerilla gonerilla*, widespread throughout the North and South Island of New Zealand, as well as some nearby offshore islands, and *V. gonerilla ida*, found only on the Chatham Islands. The taxonomic split of *V. gonerilla* is based upon evidence of colour variation and scalloping indentations between the veins on the hindwings. This study aims to provide taxonomic clarity using a combination of phylogenetic analysis to support the existence of a single or two closely related, but differentiated, mitochondrial lineages, and morphological markers in identifying hindwing variation as a quantifiable characteristic.

Plate 1. Upper and lower surface of *V. gonerilla gonerilla* (above) *and V. gonerilla ida* (below) Gibbs, 1980

10:00 The New Zealand Mosquito Census: A three-year retrospective

Hovius, A.[1], Kasper, J.[2]

[1]*Victoria University of Wellington, School of Biological Sciences, Wellington, New Zealand.*

[2]*Te Papa Tongarewa – the Museum of New Zealand, Wellington, New Zealand.*
email: Julia.Kasper@tepapa.govt.nz

Since 2020, the "New Zealand Mosquito Census" has been supplementing existing mosquito monitoring initiatives with specimens collected and submitted by kiwi citizen-scientists. The census' primary goal is mapping the occurrence, behaviours and distributions of our 13 native and three introduced mosquito species. Furthermore, the opportunistic nature of the project and its broad geographic coverage lends additional function for early detection of exotic incursion, and supports related research and monitoring initiatives.

A heightened public and media awareness of public-health monitoring, particularly in the context of the SARS-CoV-2 pandemic, has together with media reporting of mosquito-related topics reliably supported participation. We will discuss where we have had success in prompting submissions and encouraging engagement.

With over 650 submissions identified to date, the preliminary performance of the census as a monitoring methodology and outreach program, can be discussed. The census' aptitude in covering diverse biotypes will be demonstrated, and regions underrepresented in existing monitoring and census data will be highlighted. Spatiotemporal variability in the number of submissions will be examined though the lens of underlying anthropogenic and environmental factors, and other general trends in the data will be explored. Providing suggestions and design considerations for this and similar projects in future.

10:15 The global spread of misinformation on spiders

Painting, C.J.[1], Walker, L.[2]

[1]*University of Waikato, Te Aka Mātuatua School of Science, Hillcrest Road, Hamilton, New Zealand.*

[2]*Auckland University of Technology, Department of Environmental Science, 55 Wellesley Street, Auckland, New Zealand.*

email:chrissiepainting@waikato.ac.nz

The Internet keeps us connected, but can amplify the spread of misinformation. The magnitude of this problem is gaining global relevance, as misinformation interferes with democratic processes and undermines collective responses to environmental and health crises. Therefore, understanding how misinformation generates and spreads is a pressing challenge. With more than 60 collaborators, we collated a high-resolution database of online newspaper articles on spider-human interactions, including articles from New Zealand. Spiders are widely feared animals that frequently appear in the global press. Our database covers a global scale (5,348 news articles from 81 countries and 40 languages) while providing an expert-based assessment of the content and quality of each news article. We found the quality of news on spiders to be exceedingly poor—47% of articles contained errors and 43% were sensationalistic. However, the consultancy of spider experts, but not doctors and other professionals, decreased sensationalism. We found that the flow of spider-related information occurs within a highly interconnected global network. Our results improve understanding of the drivers of (mis)information across broad-scale networks. For spiders, a more accurate media framing would translate into measurable benefits, limiting resource waste and mitigating human-wildlife conflicts and the prevalence of widespread arachnophobic sentiments.

11:00 Developing new harmonic radar tools for tracking flying and terrestrial insects

Pawson, S.M.[1], Afroz, R.[2], Lavrenko, A.[3], Storz, G.[4], Woodward, G.[2]

[1] *University of Canterbury, School of Forestry, Steve.Pawson@canterbury.ac.nz*

[2] *University of Canterbury, Wireless Research Centre*

[3] *University of Twente, Twente, Netherlands*

[4] *Storz Consulting, Auckland*

Understanding the behaviour of insects in both a spatial and temporal framework is crucial for effective conservation and pest management. Collecting data at a fine temporal resolution is extremely challenging for long periods under field conditions, i.e., tracking location of an insect every second. Harmonic radar has been used for four decades to 'track' insects, however in most cases it has been applied to periodically relocate individuals. To date, few systems exist globally to support studies at fine temporal resolutions. Existing solutions are generally bespoke, large, expensive and require specialist radar skills to support. We are currently developing a compact 9/18GHz radar that aims to permit the tracking of flying insects by mounting to a UAV or terrestrial insects by a fixed arena of approximately 50 m square. We present an overview of the concept, its limitations, past implementations, progress to date, and our plans for the next two years.

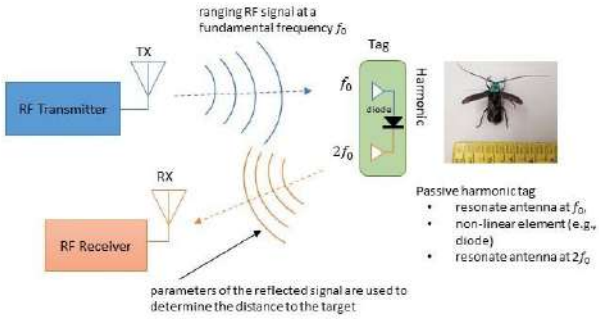

Figure 1. The Harmonic Radar (HR) principle

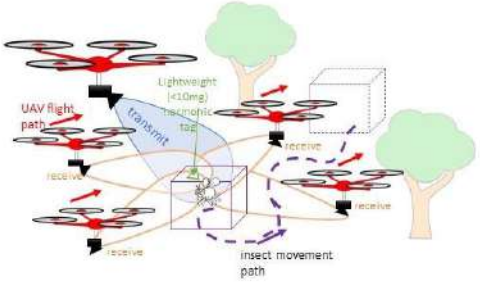

Figure 2. Distributed mobile radio-localisation system for real-time insect tracking with UAVs

11:15 Predicting the current and future potential distribution of *Bactericera cockerelli*

Suwandharthne, N. I.[1,2,] Avila, G. A.[1], Holwell, G.I.[2]

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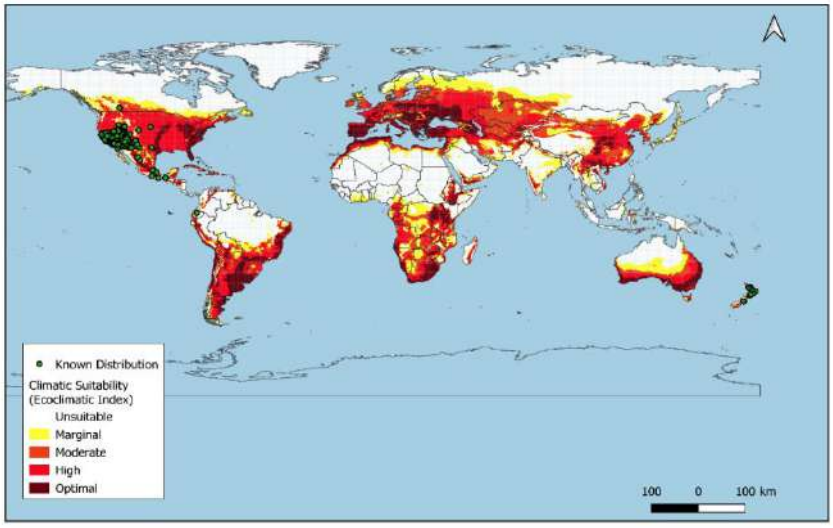
Understanding and predicting the climatic suitability for invasive insect species has shown growing demand, as climate change and invasive pests together pose significant risks to biosecurity. The invasive pest *Bactericera cockerelli*, commonly known as tomato potato psyllid (TPP), is native to North America and has recently invaded Australasia. We used the niche modelling software CLIMEX to predict the potential geographical distribution of TPP in New Zealand and worldwide under current and future climatic scenarios. In its native range, TPP is predicted to expand its current geographic range in semi-arid, temperate, and continental climates. The model predicted that areas in Europe and East Asia are climatically suitable for the potential establishment of TPP. In New Zealand, most regions are climatically suitable for TPP except the West Coast and Tasman regions of the South Island. Predictions under a future climate change scenario showed a significant reduction of the geographic range of TPP, and a possible expansion towards higher latitudes while New Zealand will be climatically more favourable. The CLIMEX projections for both current and future climatic scenarios provide valuable information for existing and future management programs, which may prove helpful in identifying potential areas that are likely to be susceptible to TPP invasion.



11:30 Using isotopes to assess provenance of biosecurity risk insect pests: real world forensics

Peter W. Holder[1], David Murphy[2], Kiri McComb[3], Robert Van Hale[3], Karen Armstrong[1]

[1] *Lincoln University, Department of Pest-management and Conservation, Lincoln 7647, New Zealand.* *peter.holder@lincoln.ac.nz*, *karen.armstrong@lincoln.ac.nz*

[2] *Queensland University of Technology, School of Earth & Atmospheric Sciences, 2 George St*

Brisbane, QLD 40010, Australia.

[3] *IsoTrace NZ Limited, 167 High Street Dunedin New Zealand.*

In the context of biosecurity, knowing the point of origin of pests detected in surveillance and border security programs can be of significant practical, economic and social value. Provenance information can identify risk pathways, as well as distinguish whether samples from surveillance traps are non-established new arrivals – or if they represent an established population. This information can direct appropriate operational actions in exotic pest exclusion and eradication campaigns, as well as support maintenance of "area free" pest status and thereby preserving export trade access.

Through our work and that of others, we are now confident of the potential for entomological provenance resolution through the multivariate examination of both climatically and geologically linked spatial markers, namely the isotope ratios $\delta^{2}H$, $\delta^{18}O$, $^{87}Sr/^{86}Sr$, and select trace element concentration profiles.

Here we will outline the issues identified in real-world incursion case-studies and update recent progress. This includes fit-for-purpose analytical method development, biosecurity scale appropriate urban/ peri-urban reference data generation, and geo-statistical interrogation. If you're very lucky, we may also ponder the value of lead-isotopes as urban forensic markers.

11:45 Nutritional profiles of New Zealand invertebrate taxa for evaluating candidates for aquafeeds

Brown, S.D.J.,[1*] Watt, M.A.,[1] Afsar, S.,[2] Cooney, J.,[3] Poulton, J.,[1] Todd, J.,[1] Davis, V.,[1] Page-Weir, N.E.M.,[1] Fletcher, K.,[2]

[1]*New Zealand Institute for Plant and Food Research, Mount Albert Research Centre, Private Bag 92169, Auckland 1142, New Zealand.*

[2]*New Zealand Institute for Plant and Food Research, Fitzherbert Science Centre, Private Bag 11600, Palmerston North 4442, New Zealand.*

[3]*New Zealand Institute for Plant and Food Research, Ruakura Research Centre, Private Bag 3230, Waikato Mail Centre, Hamilton 3240, New Zealand.*

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The use of insects as ingredients for other products is a burgeoning industry globally. One particular application is as a protein source to replace fishmeal in aquafeeds. Two species, black soldier fly (*Hermetia illucens*) and mealworms (*Tenebrio molitor*) have received the most attention in this space, but these species have been chosen for their ease in rearing and not for their nutritional properties. Recently, we have been measuring the fatty acid and amino acid profiles of a wide range of invertebrate taxa. Medium-length saturated fatty acids dominate the lipid profiles of most taxa, but longer-chain polyunsaturated fatty acids are also present in reasonable amounts in some species. There are strong indications that diet and habitat play an important role in the composition of lipid profiles. Several species have reasonable amounts of the valuable amino acids methionine and taurine. Overall, many of the invertebrates sampled to date have promising nutritional properties. Incorporation of meals from several different species may result in a more nutritionally balanced product.

13:15 The new storage project at Te Papa's entomological collection

Kasper, J.[1], Sirvid, P.[1]

[1]*Museum of New Zealand Te Papa Tongarewa, Wellington.*

email: julia.kasper@tepapa.govt.nz

Te Papa's insect collection is a major scientific resource and a national record of our natural heritage. Therefore, effective and efficient storage of the collection is essential to ensure the conservation of specimens for use by future generations.

The entomology collection was, until recently, housed in a plethora of different cabinet types and drawer sizes, which partly dated back to the museum's beginnings, and with a great variety of materials, such as Medium Density Fibreboard (MDF). MDF emits formaldehyde, which is detrimental to object preservation. Consequently, it is recognised globally as inadequate for long term collection storage. Over time, many of the cabinets have become broken or warped, rendering them unsafe for storage, particularly in a disaster situation such as fire, flooding or earthquake.

During the new storage programme, we came up with a solution of insect metal cabinets housing wooden Cornell drawers to meet internationally accepted archival standards and disaster management strategies.

Now the game of musical Chairs has begun. The specimens are moving into their new housing following a complex plan that allows juggling of old and new cabinets in a very limited space over an extended time as delivery of new storage is staggered over several years.

13:30 Development of an online virtual plant pest reference collection – PHELdi (Plant Health and Environment Lab Diagnostic Images)

Shen, J.W.[1]

[1]*Ministry for Primary Industries, Plant Health and Environment Laboratory, 231 Morrin Road, St. Johns, Auckland, New Zealand.*

email:Jiawei.shen@mpi.govt.nz

Plant Health and Environment Laboratory Diagnostic Image (PHELdi) is an open access online database of plant pest species and diseases of biosecurity importance to both New Zealand and the Pacific. Each entry comprises taxonomic information, diagnostic notes and images, distribution, commodity type, reference and external weblinks. It was developed to facilitate the identification of potential plant pests, and to assess the biosecurity significance of a pest species to the local environment. This virtual database was designed to be of great use especially for Pacific Island countries that lack both taxonomic expertise and facilities for physical specimen collections. It aims to deliver high quality diagnostic images with critical peer-reviewed species information for more than 1000 species to the public. These species records are fully searchable by species name, common names, key diagnostic characters or associated commodities. All records can be downloaded in PDF fact sheets format for easy identification, quick communication, and fast response. These fact sheets are automatically generated and auto-updated when edits are made to any species records.

PHELdi will be uploaded into the external portal (MPI.GOVT.NZ) and will be publicly accessible from the MPI external website.

13:35 Digitisation of the Otago Museum Bulletins

Fleury K.F.[1], Burns E.[1]

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2023 marks what would have been Raymond Robert Forster's 100th birthday. The Otago Museum has celebrated Forster's life and this occasion by creating a small display case in the Forster Hall in the nature gallery of the museum, and by scanning and making available digital copies of the Bulletins of the Otago Museum. These bulletins are critical pieces of research that underpin much of New Zealand's spider research and second-hand copies of these books are becoming increasingly rare.

13:40 A family affair, the Hitchings impact on the Canterbury Museum mayfly collection

Ridden J.D.[1]

[1]*Canterbury Museum, Curatorial Team, Rolleston Avenue, Christchurch, New Zealand.*
email: JRidden@canterburymuseum.com

The Canterbury Museum Mayfly Collection encompasses over 49,000 specimens and continues to grow. In 2021, this collection was published to the Atlas of Living of Australia (ALA; https://collections.ala.org.au/public/show/dr17655) and the Global Biodiversity Information Facility (GBIF; https://doi.org/10.15468/5ksxu8). The collection has been actively curated and added to by father and son duo and Canterbury Museum Research Fellows, Terry and Tim Hitchings for the last 30, and 10 years, respectively. This talk will provide an overview and description of the collection, the data associated with it, and the input the Hitching's have had. The process of cleaning and preparing the data for publication to ALA and GBIF will also be covered.

Poster abstracts (alphabetical by first author's surname)

Bioconversion of organic waste using mealworms

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Organic waste generated from food production systems can present a waste disposal challenge. Feeding of this waste to insects has the potential not only to dispose of it, but also to produce a product that could be used in other applications (e.g. a feed source for the production of insects as fish food). An example of a significant waste streams in Aotearoa New Zealand is grape marc, the solid waste product from the wine-making process, comprising the skins, seeds and stems of grapes along with winery lees, the dead yeast cells and particulates that collect at the bottom of a vat after the fermentation and aging process. In this trial, mealworms (*Tenebrio molitor*) were provided the following feeding substrates, singularly or combined: grape marc, ground Greenshell™ mussel shells, and winery lees. The organic wastes provided in these trials were sourced from the Marlborough region. Mealworm feeding and development on these organic wastes were observed. Results have indicated that mealworm larvae can feed and survive on grape marc and, to some extent, on ground mussel shells. Wine lees were a problematic feeding substrate, and further investigation is required into possible pre-treatments.

Precision glycerine jelly swab for removing pollen from small and fragile insect specimens

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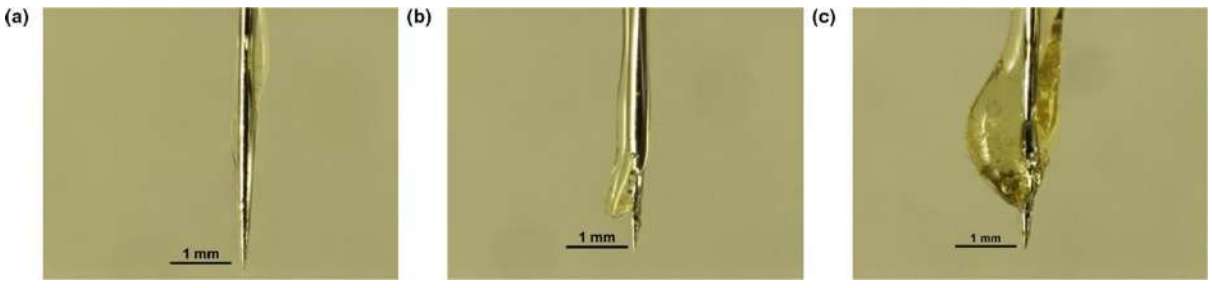
Historical datasets can establish a critical baseline of plant–animal interactions for understanding contemporary interactions in the context of global change. Pollen is often incidentally preserved on animals in natural history collections, and there is a need for a method to extract pollen from these small and fragile insects. Here, we detail a precision glycerine jelly swab tool to allow for the precise removal of pollen from old, small and fragile insect specimens. We use this tool to remove pollen from five families of insects collected in the late 1970s. Additionally, we compare our method with four previously published techniques for removing pollen from pinned contemporary specimens.

We found that across the five methods, all removed pollen; yet, it was clear that some are better suited for fragile specimens. Specifically, the precision and standard swabs performed best. This method permits sampling pollen from a variety of insects in natural history collections. These pollen samples can then be identified with either microscopy or DNA sequencing, and the resulting plant–insect interaction data can establish historical baselines for contemporary comparison. Additionally, this tool can be used to explore pollen placement specialisation or to sample bryophyte, fungal and tree fern spores dispersing on animals.



a–c are examples of the different sizes of the precision glycerine jelly swabs on 00 entomological pins. Note that b and c are post-pollen sampling, and pollen and dislodged setae can be seen.

Observed insect-host plant association: *Ichneutica steropastis* Meyrick, 1887 (Noctuidae) on *Gahnia xanthocarpa* (Hook.f.) Hook.f. (Cyperaceae)

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Patterns and explanations of host plant associations are diverse among insects due to the range of generalist and specialist diets. In Lepidoptera, the larvae are the prominent feeding stage of each species and are often restricted to a single host, however, the current data on food plants and host specificity outlines the need for further research. New Zealand Lepidoptera are comprised of over c. 1800 species, at least c. 1600 of which are endemic. With such a high degree of endemism, relevant information needs to be increased in order to effectively manage vulnerable and/or unknown species. *Gahnia xanthocarpa* (Cyperaceae), a monocotyledonous flowering plant distributed throughout the North and South Islands, has c. 4 known Lepidopteran associates. *Dodonidia helmsii* (Nymphalidae: Satyrinae) is a notable species which utilises *G. xanthocaroa* in the northern part of its' range, however, little information is available regarding other Lepidopteran fauna which consume the same plant. By sampling and rearing larvae observed on *G. xanthocarpa*, *Ichneutica steropastis* (Noctuidae) was discovered and confirmed as sharing a host plant association. This endemic moth is commonly known for the notching damage it causes to the leaves of its original host, *Phormium tenax* (Asphodelaceae).

The Hudson 100 Year Moth Project

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George Hudson spent 50 years collecting moths in the Wellington suburb of Karori - from the early 1900's until the 1950's. One hundred years later we spent three years collecting moths in the Zealandia ecosanctuary and comparing species presence, potentially affected over time by climate and habitat change - from agricultural land to regenerated native forest.

Initiated by Wellington's Pepeke group, members of DOC, Te Papa and Zealandia engaged with volunteers during the bi-monthly sample trips after dark. Light traps were used to attract moths, which were caught carefully by hand. The specimens were pinned and deposited at Te Papa. Experts were identifying the species thanks to iNaturalist.

Hudson collected 435 moth species, but only 57 species in the Reservoir Reserve, which was our collecting area and is now part of Zealandia. We have collected 241 species, including 30 Hudson found too. We are missing 27 moths he found, but in general the diversity appears to have increased. This may reflect the regeneration of Zealandia, which enables more species to live there due to greater host plant availability. Also new moth arrivals from overseas have established themselves in New Zealand and now can be found in Zealandia as well.

Insect name tags – Cuticular hydrocarbon analysis of *Monomorium antarcticum* populations

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One insect's cuticular hydrocarbon (CHC) profile can contain over a hundred different compounds which reflect their genetic heritage, their reproductive state, and the physical environment they live in. Eusocial insects use the CHC profile odour like name tags that detect complex information about insects about the life history of their colony and the role they play within it.

Monomorium antarcticum (Chelaner antarcticus) is a highly diverse and ubiquitous species of endemic ant. *M. antarcticum* colonies can have multiple reproductive queens (facultative polygyny), but little is known of how that may affect colony function and behaviour. *M. antarcticum* consists of a species complex that is difficult to untangle using morphological and genetic analysis.

By developing a specific gas chromatography – mass spectrometer protocol, I could highlight differences in CHC profile between *M. antarcticum* queens, alates, and workers from different colonies, revealing how they communicate their population ecology and reproductive dynamics to each other. While workers from different colonies had a surprisingly similar CHC profile, queen profiles were hugely varied. This initial profile shape and new CHC analysis protocol is the first step to understand behaviour, ecology and even taxonomy of this endemic species.

Assessing anthropogenic climate change in Hawkes Bay, New Zealand, using a thousand-year midge-based temperature reconstruction

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Lakes in Aotearoa New Zealand are taonga, possessing strong cultural, ecological, and economic value. However, these delicate ecosystems are being threatened by anthropogenic climate change. This study aims to investigate whether there is evidence of anthropogenic climate change in a lake of good ecological condition within Aotearoa New Zealand. The study focuses on Kaweka Lake, located in the Hawke's Bay.

In this study, we will reconstruct the last 1,000 years of climate history, which encompasses the Medieval Warm Anomaly (MWA) when temperatures were on average 1 to 2°C warmer than during the mid-20th century. Consequently, the MWA may serve as a useful analogue for future warming.

Chironomids (Order: Diptera) are a useful tool for identifying historical changes in climate, as the family is sensitive to summer temperature and larval head capsules are preserved by lake sediments. Along with past climate, lake ecosystem diversity will be assessed with environmental DNA, catchment vegetation will be characterised using palynology, and surface processes will be approximated with µ-XRF. Together, these data will provide a multiproxy perspective on the impact of global warming on lake ecosystem function in Aotearoa New Zealand.

The threats presented by invasive spider species to New Zealand's threatened katipō spider (*Latrodectus katipo*).

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When two species demand the same resource, the availability of that resource to one species may be limited by the presence of the other. Katipō (*Latrodectus katipo*) and false katipō (*Steatoda capensis*) possibly demonstrate shared resource demand consequences.

False katipō are ongoingly hypothesised to be displacing the katipō. I will investigate the potential competitive consequences to the threatened katipō posed by false katipō. To do this, I will examine a population of katipō and false katipō in sand dunes at the Tara iti Golf Course in Te Aria, Auckland. Studying this katipō population is particularly important as published studies on North Island populations are relatively rare compared to South Island populations.

I have proposed four research questions for this study. I will examine the phenology of katipō and false katipō by comparing reproduction and development using survey methods in the field. Secondly, I will compare male dispersal behaviours between katipō and false katipō using exploration assays as a proxy for dispersal. The final two research questions will compare establishment behaviours. I will compare the time taken to build a new web, and I will compare displacement behaviour. In the displacement behaviour experiments I will test if katipō can establish in a microhabitat which a false katipō has already established and vice versa.

My proposed research will assess the evidence for competition between katipō and false katipō which will ultimately aid in the conservation and recovery of katipō.

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 stranger to New Zealand 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 exports standards set by the Ministry for Primary Industries, 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 the area of cerambycid pheromones 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 various 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 New Zealand.

Tiny but mighty: success of the giant willow aphid biological control agent

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Releases of the parasitoid *Pauesia nigrovaria* (Hymenoptera: Braconidae: Aphidiinae) to control giant willow aphid (*Tuberolachnus salignus*) were made throughout New Zealand in 2020 and 2021. Ad hoc surveys conducted in 2022 found that the parasitoid had established and dispersed well away from release sites, far exceeding expectation. It has been surprisingly easy to locate high numbers of mummified giant willow aphids in the field (and therefore confirm presence of the parasitoid). In addition, monitoring of giant willow aphid at five North Island release sites indicated a marked decrease in abundance of this pest at those sites two years post- release. Control of giant willow aphid is expected to benefit beekeepers and land managers in particular, as well as New Zealand's biodiversity through an associated decrease in numbers of vespid wasps.

Aotearoa New Zealand Cave Biodiversity Mapping Project

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New Zealand's dispersed karst regions contain caves, holding a variety of poorly understood flora and fauna. It is possible that some species found in our caves are descendants of prehistoric ancestors, living in isolation with little gene-flow. Hence, cave biodiversity offers insights into past geo-biological timelines, cave speciation and dispersal patterns not seen in surface ecosystems. Furthermore, these long term stable systems may hold a surprising amount of our country's biohistory - and unique species that can only be found in this one place in the world.

Initiated by the New Zealand Speleological Society, this project has brought together various scientific experts to map and record troglobitic species. Therefore, we are photographing cave animals in situ, including specific behaviours and locations in the caves, compiling new taxonomic descriptions, identifying any genetic differences between karst and within karst areas, and recording collected data on an arcGIS program specifically designed for cave systems.

Using a specifically designed arcGIS mapping program, troglobitic species in cave and karst regions are collated; recording and collecting new species, and looking for dispersal limits, we can start to build a picture of cave life, and where future research to fill gaps all support cave biodiversity conservation.