New Zealand Ecological Society Conference

28 November – 2 December 2022

Dunedin

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Plenary Speakers Abstracts

The role of science in wildlife conservation

Armstrong D

Biography:
Doug Armstrong is an independent wildlife scientist who recently retired as Professor of Conservation Biology at Massey University. His research over the last 30 years has addressed multiple challenges involved in conserving threatened wildlife, especially through translocations. This research has involved intensive monitoring, usually with marked individuals, and a strong emphasis on manipulative experiments, integrated Bayesian population modelling, and decision analysis. Current projects include assessing our capacity to reintroduce New Zealand birds to large landscapes, understanding the role of individual growth rates on population dynamics of turtles, and improving monitoring methods for frogs and lizards. He is a long-term contributor to the IUCN Conservation Translocation Specialist Group, including co-authoring the current IUCN translocation guidelines, and is a member of New Zealand frog and hihi recovery groups.

As ecologists we tend to take it for granted that science plays a vital role in conservation. However, it is useful to step back and consider the big question that may determine the effectiveness of our actions. For example, what are the appropriate roles of pure vs applied science and is this a sensible distinction? What are the appropriate roles of science, values and culture in decision making? When are data-based predictions essential and when can we rely on intuitive judgements? How can we predict the future value of our research in terms of conservation outcomes so we can better justify it? Can we predict whether the information gained through experimental manipulation will outweigh the short-term costs of undertaking management actions predicted to be suboptimal? I discuss these issues using examples from 30 years of research in wildlife conservation in Aotearoa New Zealand.

The East Otago Taiāpure: Lessons from community-led restoration of connected fishery ecosystems

Hepburn C[1]
[1]*East Otago Taiāpure Management Committee, University of Otago*

Biography:
For the last 15 years Prof Hepburn has supported transformative climate change, aquaculture and fisheries researchand teaching programmes in partnership with coastal communities. Key to this work is building capacity andapplying fit-for-purpose research to empower decision-makers to alter public policy surrounding marinemanagement and ecosystem restoration. He co-leads Te Tiaki Mahinga Kai a research partnership programme thatsupports local action by Tangata Tiaki/Kaitiaki (customary fishery managers) and is Co-Director of the Coastal PeopleSouthern Skies Centre of Research Excellence. He leads an active and diverse lab group and is committed tosupporting the leaders of coastal communities and training the next generation of scientists equipped to gather andshare the knowledge to better support local leaders in their work to restore coastal ecosystems.

Indigenous people often manage natural environments and resources based on landscape features. Rights and management responsibilities that follow pathways of water from their source in alpine areas down and ultimately into and out to sea are common. Contemporary frameworks that seek to support management of the environment, ecosystems and resources from marine areas to alpine zones are not so connected. Here a 25-year case study of the struggles of Kāi Tahu Tangata Tiaki (customary fisheries managers) in their restoration of local fisheries, ecosystems and practices in the East Otago Taiāpure is shared. The Taiāpure a 25 km stretch of coastline on New Zealand's South Island that Tangata Tiaki and the Taiāpure have supported appropriate science to develop a suite of management initiatives always guided by mātauranga Māori. Despite local successes in restoring habitat, changing legislation, gaining knowledge and building community support for change, fundamental issues remain. Restoring what has been damaged by decades of resource extraction and mismanagement is a generational process. Changing oceans bring new challenges and also provides huge risks to a generational rebuild. In this high stakes environment one event or mistake by a manager can put back decades of work and sacrifice. Scientists who understand and respect the knowledge and the leadership of our communities are needed. Offering support is a good first step. Too many focus on their own aspirations and problems or think they do not have anything to contribute. Connected ecosystem based management during climate change is a huge challenge for coastal communities, they are overwhelmed and need our help.

Sounding the alarm: Biological heritage of Aotearoa under threat from climate change

Macinnis-Ng C[1]
[1]*University of Auckland*

Biography:
Cate Macinnis-Ng is Associate Professor in Ecology in the School of Biological Sciences at Waipapa Taumata Rau The University of Auckland. She specialises in plant-climate interactions and has broader interests in climate change effects on biodiversity and ecosystem functioning. She was contributing co-author for the 2022 IPCC Assessment Round 6 Working Group II report on Impacts, Adaptation and Vulnerability.

Climate change impacts on biodiversity can be complex and difficult to detect. In our mild and highly variable climate, many researchers have downplayed the threat of climate chance for the biota of Aotearoa. Yet as extreme events become more frequent and severe, and climate change interacts to exacerbate other conservation threats, ecologists are detecting more and more instances of climate events threatening species, ecosystems and ecological processes. In this talk, I will introduce recent case studies from terrestrial, marine and freshwater ecosystems as examples of how biodiversity is responding to climate now. I will discuss the range of different types of studies being conducted here and overseas to better quantify the climate threat and identify key vulnerabilities. I will offer a framework of different approaches to measuring and predicting climate change impacts and finally, encourage all ecologists to consider how climate change considerations should be included in their own work.

Moonshots and J curves: misleading concepts for a predator-free New Zealand

Norbury G[1]
[1]*Manaaki Whenua - Landcare Research*

New Zealand's goal of eradicating seven pest species (possums, mustelids, and rats) from the mainland by 2050 is incredibly ambitious, making this one of the most exciting times in our history to be involved in predator management and research. With R&D progressing at breakneck speed and communities more engaged in pest management than ever before, the Predator Free 2050 initiative is being framed as New Zealand's 'moonshot'.

This inspirational analogy is, however, misplaced. Endeavours like space exploration are primarily technical challenges, whereas the challenge of mainland pest eradication includes overcoming huge social barriers, such as disengagement, mistrust, and self-interest. This 'moonshot' mentality has led to an unwarranted extrapolation of 'J curves' that entirely ignores the human dimension. These curves were originally produced to show how uninhabited islands with eradication success have expanded in geographic area in recent years. They have since been extended to the inhabited mainland by 2050, with no adjustment for the additional social barriers.

Technical challenges of PF2050 are also huge. Social licence for widespread use of lethal toxins is in decline, and despite PF2050's support for community trapping programmes, no project has yet been able to demonstrate eradication of mainland predators by trapping. Engineers are pushing technologies in some very exciting areas of pest control and detection, but every individual predator must be willing to interact with new technology, and that technology needs to be affordable to deploy at scale. New Zealand needs new 'game-changing' eradication tools.

Meanwhile, we are seeing the emergence of shifting goalposts, including pseudo definitions of eradication such as 'functional extinction' (too few survivors to interact and breed) or 'elimination' (temporary elimination before reinvasion). These are risky concepts for pests that are highly fecund (rats) or highly mobile (stoats) as they rely on assumptions about whether survivors can be left in place without them finding each other, and whether immigrants can be detected and removed before they breed.

PF2050's strategy has been to win 'hearts and minds' by calling communities to action early in the programme. The success of this approach remains to be seen, but a more considered and cost-effective strategy is to: first, undertake a feasibility study of the likelihood of mainland eradication coupled with effective biosecurity; second, restrict early field trials to large, partially inhabited islands, such as Rakiura, and defendable mainland peninsulas; and third, use this information to develop a national strategy that lays out how the first elimination areas can be protected, expanded with help from natural barriers, and eventually merged. The current scattergun approach on the mainland falls well short of these requirements.

The PF2050 programme is largely a belief system based on political will, passion, and endeavour, rather than evidence. If it fails, predator management will have nonetheless advanced significantly, and recovery of some biodiversity will ensue. But the opportunity costs are huge, and the risks of perverse social outcomes, such as disillusionment, apathy, and mistrust, are very real.

Even without eradication, PF2050 provides a superb opportunity to derive outcome-based pest management targets for future conservation. To that end, a structured monitoring programme will be needed that links predator and biodiversity responses across taxa (beyond just birds) and ecosystems.

Small mice create big problems: should Predator Free New Zealand include house mice?

Samaniego A[1], Byrom A, Gronwald M, Innes J, Reardon J
[1]*Manaaki Whenua - Landcare Research*

Biography:
Araceli is a conservation biologist with 20 years of experience, always combining biodiversity conservation projects and applied research. She has led and contributed to numerous conservation projects on islands, mainly rodent eradications, all around the globe. She is involved in the development of technological innovations to maximise conservation effectiveness. Her publications always aim to be useful to conservation practitioners.

Predator Free 2050 (PF2050) is a government initiative aiming to eradicate selected species of invasive mammals (mustelids, rats, and possums) from New Zealand (NZ) by 2050. However, 26 additional introduced mammals, including predators and herbivores, are also present. Reductionist management often has negative implications given the ecological interactions between the species targeted and excluded. Current PF2050 targets include all rat species present in NZ (*Rattus exulans*, *R. norvegicus*, and *R. rattus*), but not the house mouse (*Mus musculus*), although selecting species to include has received little discussion or detailed analysis. However, mice can be as damaging as rats when competition is removed, eventually negating rat eradication benefits. We argue multi-rodent eradications are more cost-effective and prevent mesopredator release. Using Waiheke Island as a case study, we show that adding mice to the planned rat eradication would raise costs moderately, comparing well to a separate mouse eradication later in time, which would be higher risk, more costly and more socially taxing than the preceding rat eradication. Missing the opportunity to tackle all rodents simultaneously, leaving mice to multiply in numbers and impacts, could have serious environmental and socio-economic effects. As a leader in pest eradications, NZ will influence global rodent management with these decisions.

Oral Presenters Abstracts

The suitability of radio telemetry techniques for monitoring a New Zealand frog species (*Leiopelma hamiltoni*)

Altobelli J[1], Dickinson K, Godfrey S
[1]*University Of Otago*

Biography:
Joseph Altobelli is currently a PhD candidate in the Department of Zoology at the University of Otago. Joseph studies conservation biology of New Zealand amphibians and the behavioral ecology of Leiopelmatid frogs.

The miniaturization of very high frequency transmitters over the last 20 years has allowed researchers to use radio telemetry to study the movements and behaviors of increasingly smaller animals. However, the sensitive skin of many amphibians has continued to make fitting telemetry packages difficult. Here we describe the application of a waist-harness style radio telemetry package for use on one of New Zealand's native terrestrial frog species (*Leiopelma hamiltoni*). We fitted harnesses to 41 *L. hamiltoni* in Te Pākeka/Maud Island Scientific Reserve, northern South Island to monitor their daily movements and habitat use. We tracked individuals for a maximum of 20 days and recaptured *L. hamiltoni* showed no signs of skin irritation or skin damage at the time of harness removal. Although the use of radio telemetry on leiopelmatids is not without difficulties, the observations collected during our field trials provide strong support that a waist-harness design is a suitable and effective method to conduct short-term radio telemetry on leiopelmatid frogs.

The downside of 'making do': consequences of second-rate pollination and dispersal services for native plants

Anderson S[1], Kelly D[2], Robertson A[3]
[1]University of Auckland, [2]University of Canterbury, [3]Massey University

Biography:
I am an ecologist at the University of Auckland. I am interested in mutualistic interactions between birds and plants, and their role in maintaining native ecosystem biodiversity. My research looks at the importance of birds as pollinators and seed dispersers, and whether native bird declines - and the concomitant naturalisation of a range of bird and insect species, as well as flowering and fruiting plants - have impacted native forest regeneration. The aim of my work is to better understand how these systems function, and be able to predict vulnerability in mutualisms, to inform native biodiversity management.

Many flowering plants are visited by a range of pollinators of varying effectiveness, and some are also able to self-pollinate, resulting in seeds that vary in number and quality.
Similarly, fruiting plants are usually visited by a range of dispersers of varying ability, resulting in dispersal of variable fruit sizes and distances. While this generalisation ensures a degree of redundancy, declines in native pollinators and seed dispersers mean that native plants often now 'make do' with the least effective provider. This arrangement may suffice for immediate plant persistence, but the downstream demographic costs must be considered. Here we assess the situation for a pollen-limited flowering plant, *Rhabdothamnus solandrii*, and a disperser-limited fruiting plant, *Corynocarpus laevigatus*. We compared survival and growth in seedlings from selfed vs. outcrossed seed in *R. solandri*, and from small vs. large-seeded fruit in *C. laevigatus.* Our results suggest that plant survival in the short term may not equate to viability in the long term, and that changes in mutualistic interactions may have consequences for population resilience.

Toward restoration genetics of maire tawake - a nationally critically endangered tree species

Balkwill C[1,3], Chagné D[2], Ritchie P[1], Deslippe J[1,3]
[1]Victoria University Wellington, [2]Plant and Food Research, [3]Centre for Biodiversity and Restoration Ecology and School of Biological Sciences

Biography:
I am a PhD candidate interested in developing practicable solutions to conservation issues – and seeing these implemented. Originally from South Africa, I moved to New Zealand to further my development in a place where conservation is at the forefront of everyone's minds. Since being here, I have put effort into considering not just biological aspects of conservation, but also social and cultural ones. I hope to further nurture my engagement with the peoples who have connection to the land, and through this develop solutions that are better able to take root and exhibit resilience in a changing world.

The global decline of biodiversity is among the most pressing issues facing humanity. With over 90% habitat loss, Aotearoa's swamp forests are a prime example. Wetlands are essential to ecosystem service and habitat provision and are taonga for Māori who have been disproportionately affected by declining biological heritage. The restoration of swampland is therefore vital to the recovery of both biodiversity and cultural values. *Syzygium maire* (swamp maire, maire tawake, waiwaka), is an endemic, critically endangered canopy tree species of Aotearoa's swamp forests. Formerly widespread, extant populations are small, fragmented and under pressure from myrtle rust. Information of the geographic and environmentally structured distribution of maire tawake's genetic diversity would support conservation and restoration strategies aimed at facilitating future resilience of the species. Genomic data for tree species is lacking, however, and often neglected in conservation and restoration efforts. Given this substantial gap in understanding, I am exploring the landscape level and environmental processes affecting S. maire's genetic structure and adaptive variation. In order to achieve this, I use a novel long read, high accuracy sequencing technology to enable rapid, cost effective assembly of reference genomes for Aotearoa's endemic species. I then explore a genotyping-by-sequencing approach to assess the genetic diversity, population structure and potential local adaptation of S. maire as a function of climate across New Zealand. Future work will aim to describe fine-scale genetic structure and interbreeding of maire tawake populations, followed by simulation-based approaches aimed at informing integrative restoration strategies for wetland habitats.

Conservation of New Zealand's terrestrial amphipods: the state of play

Ball O[1], Pohe S[2], Shepherd L[3]
[1]NorthTec-Te Pukenga, [2]Pohe Environmental, [3]Museum of New Zealand/Te Papa Tongarewa

Biography:
Olivier Ball has been a tutor in the Applied and Environmental Sciences Department at NorthTec since 2000. His research interests center on taxonomy of terrestrial amphipods and invertebrate community ecology.

Terrestrial amphipods (Crustacea: Amphipoda: Talitroidea) or landhoppers, are an abundant component of New Zealand's macro-arthropod detritivore communities. Despite their ecological importance, landhoppers are overlooked as research or conservation subjects. Currently, 28 native species in 17 genera are described from New Zealand. Recently, an assessment was undertaken to provide recommendations on the conservation status of all described species. Results (with number of species) were as follows: Threatened (1), At Risk (9), Data Deficient (6), Not Threatened (12). We recommended 23 species (82%) be given the qualifier Conservation Research Needed (CR), including all Data Deficient taxa and ten Not Threatened taxa. Knowledge gaps mainly stem from a lack of understanding of their taxonomic status. For example, several "species" thought to have wide geographic distributions are species complexes, some with many constituent taxa. Though such species, as defined by their type localities, may be secure, some taxa within each complex likely occupy small geographic areas and may not be secure. Thus, confusion surrounds the accurate classification of many described species, which in turn confuses their ecological story. Also, contrary to previous viewpoints, it is evident that many New Zealand landhoppers have only small areas of occupancy, and for this reason alone, may not be secure. Furthermore, recent field work has unearthed a plethora of undescribed species, most of which belong to new genera and likely also have limited distributions. Therefore, more research focusing on taxonomy and ecology is planned to improve our knowledge of the conservation status of New Zealand's landhoppers.

The Importance of Food Web Architecture for Ecosystem Functioning Across Trophic Levels and Ecosystems

Barnes A[1], Brose U[2], Gauzens B[2]
[1]*The University of Waikato,* [2]*German Centre for Integrative Biodiversity Research (iDiv)*

Biography:
Andrew is a Senior Lecturer at the University of Waikato where he leads the EcoDiv research group. He is broadly interested in the impacts of global change drivers on natural systems and the resulting functional consequences. His research focuses on how environmental changes alter the seemingly complex relationships between biodiversity, the structure of communities, biotic interactions, and ecosystem functioning.

Global evidence suggests that local biodiversity is significantly changing, which could have profound impacts on the provisioning and stability of ecosystem functions. To understand these impacts, decades of experiments have manipulated diversity and measured resulting changes in ecosystem processes, typically focusing on single trophic levels. These experiments, however, rarely consider (let alone measure or quantify) the influence of trophic interactions on ecosystem functions in naturally assembled food webs. Here, we investigate the relative influence of species richness and food web architecture on both primary consumption and predation in complex food webs. Using a database of globally distributed food webs from terrestrial, marine, and freshwater ecosystems, we quantify energy fluxes through predator-prey interactions and model the effects of species richness and a suite of food web properties on rates of primary and secondary consumption (i.e. predation). In addition to a clear influence of species richness on ecosystem functioning, we find that food web connectance, vertical diversity (number of trophic levels), the vertical distribution of biomass across trophic levels, and the trophic complementarity (interaction dissimilarity) of consumers within food webs all explain significant variation in primary consumption and predation. Our findings indicate that the positive effect of species richness on ecosystem functioning may be highly dependent on the network architecture of trophic interactions in complex, naturally assembled food webs.

Designing meaningful and innovative solutions in environmental conservation: The new role of Designers at UoA

Baron G[1]
[1]*University Of Auckland*

Biography:

Gabriela Nuri Baron is a Design academic currently working at the University of Auckland. She specializes in Design strategy at the intersection between people, their communities, and their natural environment. She has worked in Design for Conservation, Sustainability, and Social Innovation for 15+ years.

Gabriela graduated as an Industrial Designer and has a master's in Product-Service System Design from Politécnico di Milano, Italy, and a Ph.D. in Environmental/Civil Engineering. Her unique study path has led her to follow a collaborative, interdisciplinary, and systemic approach to addressing complex, global problems.

At the University of Auckland, the new Design Programmes have been conceived to tackle global complex challenges through strategic Design methodologies. Design has the power to bring technical and meaningful solutions to life, while ensuring stakeholder buy-in, feasibility and desirability. Biodiversity loss is an urgent, global challenge that requires new paradigms of being, relating to each other and our natural environment, and doing that operate from a foundational level (mental models), through a relational level (human connections, interdisciplinarity), and into a practice level (technical/tangible solutions). To respond to this challenge, we have developed a methodological toolkit comprising five stages, offering a user-friendly step-by-step "agile to deep" approach that includes 21 tools for sustainable innovation within the environmental conservation sector. This methodology is called Design for Conservation, and its goal is to foster trans-disciplinary collaboration allowing multiple types of knowledge to be expressed through highly visual, collaborative graphic canvases. We have used this methodology to run 4 full teaching cycles, where Design students have envisioned compelling, innovative projects aimed at restoring biodiversity in Aotearoa. Students have collaborated with external stakeholders (including scientists, community members, policymakers, etc), and have embodied respectful cultural practices as Tangata Tititi (Treaty of Waitangi Partners). The results of these experiences evidence the value of transdisciplinary and collaborative approaches to conservation, and the role that Design can play as a catalyst for innovation in the sector.

Keeping kea safe around new pest control innovations

Barrett B[1]
[1]*Boffa Miskell Ltd*

Biography:
Brent is a biosecurity consultant with Boffa Miskell specializing in the development of landscape-scale pest animal control strategies, on ground delivery management, technical advice and community based habitat protection. His recent work in the peri-urban landscape requires a in-depth and independent knowledge of all tools and techniques used in this industry. Brent comes from a threatened species management background working with many critically endangered parrot species in Australasia and South America. His clients range from government agencies, Jobs for Nature and PF2050 funded groups, Iwi/hapu, communities, and local councils.

To successfully achieve PF2050 objectives New Zealand will need innovative and effective tools to target pest animals across our many and varied habitats. With the initiation of the Covid Response and Recovery Fund (CRRF) in 2021 a steady stream of funding has aided substantial increases in predator control actions within large landscapes. The rapid changes in this industry have created a high demand for novel traps and detection devices, a demand that has been met with increased funding for developers to research and commercialise their products. Consequently, there has been an unprecedented rise in the development of kill devices which use a diversity of triggers, lures and kill mechanisms not previously utilised. However, with opportunity comes risk and it soon transpired that some traps were commercially available before their possible impact on non-targets, such as Kea, had been fully investigated. This presentation will highlight the innovation growth in this industry and demonstrate what technologies are on the verge of commercialisation while posing the question "how do we regulate or influence their deployment to ensure kea are safe in their natural habitats". To address this question Boffa Miskell has been providing technical input to improve the Kea Conservation Trusts document "Safe ground-based pest control in Kea habitat".

Could metabolomic profiling of host plant biochemistry improve establishment and effectiveness of weed biocontrol agents?

Barrett P[1], Fowler S[2], Subbaraj A[3], Groenteman R[2], Clavijo McCormick A[1]
[1]Massey University, [2]Manaaki Whenua Landcare Research, [3]AgResearch

Biography:
D. Paul Barrett, MSc 2000, Massey University. Technical manager at Massey for 33 years and current PhD candidate. Have collaborated with Manaaki Whenua colleagues on weed biocontrol projects for 20 years. Have co-authored 10 refereed publications relevant to this topic. I am driven to understanding how "life" interacts and functions in its broadest sense. Completed my masters on a newly established oligophagus eucalyptus beetle and its associated parasitoids. Since then, I've had a particular interest in plant-insect interaction ecology, the abiotic and biotic mechanisms governing those interactions and how these impact on invasive plant species biocontrol agent establishment and effectiveness.

Classical biological control of weeds reunites specialist co-adapted insect herbivores or pathogens with their original host plant that has become invasive in a new environment. It is often the only viable management option where weeds are well established on conservation lands. The main challenges to biocontrol agent selection, is the ability to predict agent establishment, effectiveness and safety. Well established protocols are used to assess agent specificity and safety but many either fail to establish or are ineffective when they do. A literature review revealed, where such failures occur, target plant biochemistry is seldom considered a possible factor. Abiotic and biotic factors can alter plant biochemical phenotypes, including primary nutritional and defensive secondary compounds. Such compounds can impair insect performance and population dynamics, both key elements determining establishment and effectiveness of released agents. Plant metabolomics, the study of plant biochemistry, utilises analytical chemistry, bioinformatics and multivariate statistics, to elucidate known and unknown metabolites which allows characterisation of plant biochemical phenotypes. Using invasive heather (*Calluna vulgaris*) and the biocontrol agent heather beetle (*Lochmaea suturalis*) as a model system, we present evidence of significant changes to this plant's biochemical phenotype between its native UK range and its invaded NZ range. We discuss what abiotic factors may be driving those changes and how understanding host plant biochemical responses may aid agent selection and better predict agent effectiveness.

Evidence for declining Lophomyrtus tree health and reproductive potential due to repeated attack by myrtle rust

Bartlett M[1], Soewarto J[1], Zhulanov M[1], Gillard K[1], Sutherland R[1], Balfour N[1], Smallman T[1], Pugh A[1], Fraser S[1]
[1]*Scion*

Biography:
Dr Michael Bartlett is an evolutionary ecologist in the Pathogen Ecology and Control team at Scion in Rotorua. Michael has a particular interest in co-evolutionary dynamics and how life-cycles and reproductive biology can influence evolutionary processes. Michael's current research on myrtle rust is funded by the Beyond Myrtle Rust and Ngā Rākau Taketake programmes.

The pathogen, *Austropuccinia psidii,* was first detected on mainland New Zealand in May 2017. It is now well established in areas that are climatically suitable for disease development throughout the North Island and top of the South Island. The impact of myrtle rust appears to vary significantly among the 19 native Myrtaceae reported as hosts in New Zealand (15 species and 4 hybrid taxa). The endemic genus Lophomyrtus, including ramarama (*L. bullata*), rōhutu (*L. obcordata*) and their hybrids, is reported as one of the more susceptible groups of myrtles in New Zealand. Understanding how this disease behaves over time on vulnerable host species is key in understanding its potential for wider ecological impact.

We have recorded levels of new growth, flowering and fruiting, and myrtle rust on Lophomyrtus trees through time at sites in Taranaki, Auckland and Bay of Plenty regions. Disease incidence on co-occurring myrtles within three meters of focal trees was also recorded. Our observations suggest that repeated severe disease development on Lophomyrtus across multiple seasons has resulted in significant levels of dieback and defoliation on some trees. We also record a decline in flower and fruit production across seasons, however these patterns are difficult to interpret without baseline data for these species. Disease impact and incidence on several climbing rātā species has also been recorded. At some locations that were initially disease free, a gradual increase in disease incidence and severity has been observed.

Acoustic censusing of avian species using deep clustering

Bedoya C[1], Molles L[1]
[1]*Atarau Sancturay*

Biography:
I am a Bioacoustician/Acoustic Ecologist. I develop computational/signal processing tools for the analysis of acoustic and vibrational data and use them to answer biologically-relevant questions. My areas of expertise are Computational Intelligence (Artificial Neural Networks/Deep Learning, Clustering Algorithms, Fuzzy Logic, Evolutionary Computation), Animal Acoustics (Bioacoustics, Ecoacoustics), and Biotremology (animal vibrational communication). My current research involves the development of machine learning approaches for the acoustic identification and censusing of animal individuals. In general, my main research interest is the mathematical and data-driven modelling of acoustic phenomena in collective behaviour, such as soundscapes, vibroscapes, and animal communication networks.

The censusing of animal populations is a fundamental task in ecological research and animal conservation. It allows quantifying population dynamics, evaluating the effects of conservation policies, and determining the allocation of economic resources in conservation programs. However, manual censusing is an expensive, time-consuming, and labour-intensive task; thus, it is an important bottleneck in the study and monitoring of animal populations. Despite significant efforts to address this issue acoustically (e.g., call counts, acoustic indices), a precise acoustic censusing method remains a challenge. Here, we propose a solution to this issue by combining convolutional neural networks and fuzzy clustering into a single deep clustering framework. This allows characterising vocal individuality automatically and in a way that simplifies unsupervised tasks (e.g. censusing). We tested our approach using calls from eight avian species of varied vocal complexity, including songbirds, parrots, and hummingbirds. All data were collected in the wild. Our method allows both censusing of individuals by their calls and the detection of known and unknown individuals in a territory. This approach significantly facilitates ecological research and conservation management, and demonstrates a novel, and more precise, way of performing rapid biodiversity assessments.

Cross-disciplinary collaborations bridge the gap in our knowledge of parasite diversity in New Zealand

Beer A[1]
[1]*Otago University*

Biography:
I'm a PhD candidate at Otago University. I'm presenting my recent publication which highlights collaborative work I was a part of as a natural history museum assistant curator. Prior to the museum industry, I worked as a conservation technician at DOC.

Our knowledge of parasite species diversity is limited owing mainly to the lack of taxonomic expertise, funding and a lack of interest in conducting research on parasites. Parasites often do not receive the publicity they deserve, however, if communicated effectively, parasite stories spark immense interest among the press media and the public. Furthermore, ecologists have the opportunity to work with conservation managers, museum staff and taxonomic experts to bridge the gap in our knowledge of parasite diversity. Parasites are valuable for ecosystem health and wellbeing, however, it is unfortunately predicted that many parasite species will become extinct prior to their discovery. This is primarily due to co-extinction with their host species. This is particularly true of host-specific parasites.
In this presentation, I propose to present the case studies from my recent publication "Natural history collections: collaborative opportunities and important sources of information about helminth biodiversity in New Zealand" and discuss how collaborative approaches can inform parasitologists and conservation managers.

Removing the Sting: Assessing the cultural and ecological impacts of CRISPR technology for invasive wasp control

Belcher S, Mercier O
[1]*Victoria University Of Wellington,* [2]*Victoria University of Wellington*

Biography:
I am a Post Doctorate Research Fellow at Victoria University of Wellington. I have been an ecologist for Greater Wellington Regional Council for 18 years prior to this. My research relates to the intersection of maatauranga Maori and science.

Social wasps (*Vespula* spp.) are a significant ecological risk, particularly in Aotearoa's beech forests. Wasps outcompete and consume native species and impact our social and economic wellbeing. CRISPR, gene drive technology is being explored as a method of causing infertile genotypes to dominate wasp populations. However, employing gene drive technology in co-management regimes requires community and tangata whenua acceptance. Achieving social engagement and investment also involves increasing the communities' level of understand of the technology and its associated risks, benefits and costs.

ESAT (Ecological State Assessment Tool), concomitant to the He Kete Hauora Taiao framework (Belcher, 2020), is a bi-cultural ecological assessment tool that can model the ecological health and social outcomes of implementing CRISPR through a mātauranga Māori (MM) lens. Applying ESAT to the use of CRISPR technology for wasp control may produce modelling that can help explore the ecological, cultural and economic outcomes of iwi and tikanga driven management to inform effective co-governance.

ESAT modelling showed that CRISPR is an effective wasp management technology producing strong ecological benefits. ESAT revealed that managing for whakapapa and wairua significantly improved ecological outcomes. This suggests that holistic management and indigenous biodiversity prioritisation are key strategies for protecting and preventing further degradation of our natural heritage.

Belcher, S. (2020). He Kete Hauora Taiao: A bicultural ecological assessment framework. Ph.D. Victoria University of Wellington. Wellington New Zealand.

Introduced mammalian predators shape the alpine invertebrate community

Bertoia A[1], Robertson B[1], Murray T[2], Monks J[1]
[1]*University Of Otago,* [2]*Department of Conservation*

Biography:
Aaron Bertoia is a PhD candidate from Alberta, Canada. He completed his master's degree at the University of Otago on the ecology of the orange-spotted gecko (Mokopirirakau 'Roy's Peak'). He has continued his studies on how introduced predators influence the alpine invertebrate community. Aaron is interested in applied ecological issues, invasion ecology, and alpine ecosystems. When he isn't working on his research, he can be found walking a trail with his dog Griff.

Invertebrates fulfil many important roles in ecosystems, yet knowledge of this group is limited, especially in the wildlife conservation space. This is particularly true for invertebrates that reside in the alpine zone, a characteristically cold and rugged habitat located above the climatic tree line. A known threat to native fauna across New Zealand is introduced, mammalian predators. Stoats and mice are resident in the alpine zone, while rats, cats, possums, and hedgehogs are occasional visitors. These predators have decimated other native alpine fauna in addition to invertebrates at lower elevations, but we do not know how they influence invertebrates in the alpine zone. In this study, we focus on large-bodied invertebrates (>1cm in body length) as their relatively large size makes them prey for introduced predators. We used pitfall traps to sample the large-bodied invertebrate community at multiple alpine sites across the South Island. Our chosen sites represent a spectrum of predator presence, from offshore islands with effectively no predator activity to uncontrolled mainland sites where multiple predator species are active. We aimed to better understand how the large-bodied invertebrate community is influenced by varying levels of predator presence with a particular focus on mice. We sampled 1,336 invertebrates from eight sites from November 2021 to March 2022. Invertebrate community composition was influenced by the predator community as well as the presence of mice alone. Mice may be a particularly influential predator for ground wētā and should be included in future predator control plans.

Urban Ecology Management- weaving connections between knowledge, places, and people to make conservation easy and meaningful.

Biaggio D[1]
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Biography:

Daniela has been managing the Urban Ecology Team in Wellington City Council for the last five years and is now focusing on the city's biodiversity strategy. She holds an MSc in Ecology from the University of Toronto after which she spent years working in conservation NGOs across the globe before settling in Aaoteroa. Daniela is passionate about putting nature at the heart of decision making for our society and she is inspired by the incredible mahi of all those working for the environment every day.

Urban systems are one of the world's most dynamic and increasingly predominant environments. There is huge need to better plan and develop our urban areas and urban ecology can provide solutions to deliver improved outcomes for nature and people in cities. Innovative solutions are often the result of an individual or a group of visionaries and their hard work, connecting those people to the opportunities and resources is a key element for cities to achieve change. Urban ecology solutions may come from a myriad of fields beyond ecology; Mātauranga Māori, geography, policy, engineering, urban planning, sociology, economics etc. Connecting the knowledge with practitioners and decision makers at the right time for opportunities to take flight is key to make strides for nature to thrive in rapidly changing urban environments. We share case studies on working together and why a weaver may be the most pivotal role for nature to thrive in our cities.

Acoustic monitoring of forest birds on a landscape scale

Bollongino R[1]
[1]*Project Janszoon*

Biography:
I came to NZ in 2015, leaving behind Germany and my previous career in palaeogenetics. Currently I am working as a science advisor for Project Janszoon with a focus on outcome monitoring. The main projects are mark-recapture monitoring of carnivorous land snails and using bioacoustics to assess forest bird recovery.

In the Abel Tasman National Park, the distribution of rat sensitive forest birds like robin, creeper and rifleman is limited to higher elevation where rat densities are lower. Acoustic recorders were used to monitor if birds expanded towards the lowland in response to aerial rat control.
A total of 120 sampling sites distributed along six elevational strata were implemented in 2019 and 2020. Recorders were deployed for 14 days, recording 5h per day. Bird species were annotated manually using AviaNZ applying a sub-sampling rate of 90 s per day under a 15 s intermittent sampling regime, a total of 21 mins per site. Results showed that birds were likely to be detected when call rates were > 1%.
The results were also used to assess detection sensitivity to improve sampling efficiency for birds with low call rates. This study provides general guidelines to infer sampling strategies based on call rates.
Acoustic monitoring delivered similar results as human observers but without their inherent bias and results were replicable between monitoring seasons.
Additionally, call rates indicated to be a proxy for abundance on a landscape scale. In sum, acoustic recordings delivered reliable and less biased data that tell more than mere occupancy of bird species.

Bioacoustic monitoring of lower North Island bird communities before and after aerial application of 1080

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[1]*Victoria University of Wellington*

Biography:
Roald Bomans has a background in Ecology and Biodiversity and Environmental Science. He completed his Master's thesis at Victoria University of Wellington in 2018, studying bioacoustics and their use in monitoring native bird species across aerial 1080 operations. Roald is currently working as an Ecologist in the lower North Island, with experience in pest plant management and native forest restoration.

There is continued debate surrounding aerial 1080 (sodium monofluoroacetate) predator control operations in New Zealand, with claims that operations cause forests to "fall silent". We used bioacoustics to investigate these claims, recording and quantifying birdsong around three separate operations in the lower North Island of New Zealand. A Before-After/Control-Impact (BACI) design was applied, with simultaneous monitoring carried out in treated and untreated sites.

Short-term, the interaction between treatment and time and the "BACI contrast" was tested for both silence and species' calling rates. After each operation, the amount of silence was the same or lower in sites treated with 1080 relative to paired non-treated sites. Seven taxa showed no evidence of an effect of 1080, while two of 29 taxa/treatment tests showed a significant interaction between treatment and time consistent with the silent forest hypothesis: chaffinch and tomtit calling rates each declined following one of the three operations monitored respectively. At $p < 0.05$, one or two "significant" results in 26 may be expected by chance.

Longer-term trends were assessed for morepork (*Ninox novaeseelandiae*), comparing calling rates for one area not receiving treatment to one area receiving two 1080 treatments over a four-year period. A significant quadratic effect of time since treatment was found, with calling prevalence predicted to increase for 3.5 years following treatment before falling.

Overall, we found little evidence of forests falling silent after aerial 1080 operations and evidence for a net-positive effect of operations on morepork populations. The methods and findings of our studies are discussed.

Helping to inform decisions about managing multiple plant species invasions when their interactions influence their impact

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Biography:

Angela is an ecologist interested in community ecology, supporting evidence-based decision-making, and involving people in science and conservation. She leads the research area on weed invasion ecology at Manaaki Whenua and was seconded to the Parliamentary Commissioner for the Environment's office to help with the Space Invaders investigation in 2021. She has also coordinated the NZ Garden Bird Survey for the past 2 years.

Invasions by multiple non-native plant species are globally common. In Aotearoa, more than half of the plots in the National Vegetation Survey databank that contain any non-native plants have more than one non-native species. Risk assessments tend to consider impacts of individual species in isolation, which can lead to prioritising control of the species with highest expected impact. Co-occurring non-native plants could have greater or smaller impacts compared to single species invasions depending on how multiple non-natives interact to alter their abundance or per capita impacts. Synergistic interactions, such as facilitation, may lead to greater combined impact. However, if management focuses on a single non-native species, suppressive interactions could produce unintended consequences, such as the release of a co-occurring non-native species with stronger impacts.

We reviewed how different interaction mechanisms could affect non-native species abundance or per capita impact, and thus determine how the impacts of co-occurring non-natives might differ from single species invasions. The mechanisms we described highlight where better evidence or knowledge is needed to predict the combined impact of co-occurring non-native species and which management approaches can mitigate these impacts. We used a decision support pathway to show how improved understanding of co-occurring non-native plant species and their interactions can support management decision-making, including prioritising which species to target or the sequence in which species removal is done to minimise detrimental impacts on communities and ecosystems.

Auckland urban epiphytes – a nexus of invasion?

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[1]*The University Of Auckland*

Biography:
James is a teaching fellow-cum-lecturer at the University of Auckland, a plant ecologist with interests in ferns, sailing, and dumplings.

Urbanisation has resulted in biodiversity homogenisation and driven changes in epiphyte communities. Epiphytes increase landscape heterogeneity and provide for an array of ecosystem services, leading them to be used as an indicator for environmental health. Epiphyte communities are influenced by phorophyte characteristics, with palms driving distinct epiphyte communities given their unique architecture. Further, exotic phorophytes frequently facilitate exotic epiphytes. However, the nature of urban vascular epiphyte communities and potential for exotic trees to support invasive weeds as epiphytes is under-studied. Auckland is an excellent location to examine relationships between native and non-native phorophytes and epiphytes, with a rich urban forest of exotic tree species, native tree species, and palms (e.g., *Phoenix canariensis*). We examined the vascular epiphyte communities across Auckland by: (1) sampling epiphytes on trees along an urban gradient (relative built area to green space) to identify frequently occurring epiphyte taxa, epiphyte-rich phorophyte taxa, and examine patterns in and drivers of epiphyte community, and (2) surveyed a subset (n = 200) of mature exotic and native trees (incl. palms) from the Notable Tree Schedule to explore the relationship between exotic and native phorophytes and epiphytes. Our analysis highlights associations between specific non-native phorophyte and non-native epiphyte taxa and the urban phorophytes that support the richest epiphyte communities. We identified an ornamental, non-native epiphyte taxa that appears to be expanding from gardens and establishing as a novel invasive epiphyte in Auckland. The presentation will examine progress into the investigations into Auckland's epiphyte communities.

A restoration ecology conundrum: unintended consequences of a successful flax weevil (*Anagotus fairburni*) translocation to Mana Island and importance of its pathogen *Beauveria pseudobassiana*

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[1]*Massey University,* [2]*Lincoln University,* [3]*Te Papa Tongarewa*

Biography:
Will Brockelsby is keen entomologist, invertebrate ecologist and iNaturalist addict. While not specialised in any particular taxa, he does have a soft spot for charismatic large weevils, moths and harvestmen. Particularly interested in the conservation of invertebrate species, their habitats and a volunteer trapper when he finds the time.

The flightless endemic flax weevil (*Anagotus fairburni*) was deliberately translocated to Mana Island, New Zealand in 2004 and 2006. The weevil population grew exponentially and by 2018 the weevils had destroyed large areas of their host plant (Phormium spp.) on the island, to the point there was concern they were limiting the flax resources essential to native birds and lizards.

Investigations into possible natural enemies of *A. fairburni* led to the discovery of a strain of entomopathogenic fungus *Beauveria pseudobassiana* at the release site on the island that was highly lethal to weevil larvae. This native pathogen was abundant at the flax weevil release site, but uncommon elsewhere on the island, leading to the hypothesis that flax weevils were able to disperse ahead of its natural enemy. We investigated the feasibility of spreading *B. pseudobassiana* ahead of the weevil dispersal, to protect flax plants from collapse and death.

A trial site was established in the centre of the island well ahead of known weevil distribution. In March 2020, 43 marked flax plants were treated with either the virulent *B. pseudobassiana* strain or a control solution. The flax plants were then stressed by deliberately introducing flax weevils.

The application of *B. pseudobassiana* failed to protect flax plants at the experimental site, with 35 out of 43 marked plants now (2022) in a state of heavy collapse or death. However, Beauveria appears to be spread by the adult weevils as they move across the island.

Restoration of New Zealand SubAntarctic Islands

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[1]University of Auckland, [2]Department of Conservation, [3]Deaprtment of Conservation

Biography:
Keith Broome is a technical advisor for Department of Conservation specialising in animal pest management with a particular interest in the eradication of invasive species from islands. He chairs the Department's Island Eradication Advisory Group.

Land is scarce, largely uninhabited and vitally important to nature in the subantarctic region of planet Earth. New Zealand manages five island groups in the Southern Ocean New Zealand subantarctic region, a UNESCO World Heritage Area. Over the last few centuries these islands have undergone discovery, exploitation, in some places a short history of settlement, or epic human survival. Alongside this human contact came introductions of animals and plants causing change to the natural ecosystems. Their preservation commenced in the early 20th century and restoration in the late 20th century. This symposium is to chart the progress of that restoration and tell some of the stories of the ambitious, pioneering and ultimately successful work done to date to provide the foundation for our next great challenge. The only introduced mammal species remaining in the New Zealand subantarctic region are pigs, cats and mice on the main Auckland Island, the largest of all of them by a wide margin. The Department of Conservation undertook research and development to determine the feasibility of a multi-species eradication programme on Auckland Island. Should we do it? Can we do it? What will it take to succeed? The outcomes of the feasibility programme not only inform eradication on Auckland Island but have wider applicability to other eradication programmes throughout the Southern Ocean. The programme itself provides an exemplar of how to approach complex eradication problems.

Conspicuous, green flowers are an honest signal of nectar rewards in tree fuchsia (*Fuchsia excorticata*, Onagraceae)

Lim G, Burns K
[1]*Victoria University Of Wellington*

Biography:
KC is a field biologist who's interested in a wide range of topics involving the ecology and evolution of plants and animals. Rather than focus on a single type of organism, study site, methodology or hypothesis, his research directions result spontaneously from field observations. As a result, his research program encompasses a diverse array of disciplines in evolutionary ecology, from comparative psychology, animal cognition and behaviour, to plant-animal interactions, plant morphometrics, plant macroecology and plant macroevolution.

Bird pollinated flowers typically appear 'red'. *Fuchsia excorticata* (Onagraceae), a gynodioecious tree species endemic to New Zealand, is a notable exception. It produces 'green', cauliflorous flowers at early stages in flower ontogeny, when pistils are receptive. Flowers later turn 'red' as they lose their receptivity. We conducted field observations and spectrographic analyses to test whether: (1) receptive, green-phase flowers are actually more conspicuous to avian pollinators against their natural backgrounds than red-phase flowers, (2) green-phase flowers produce more nectar, and (3) relationships between flower conspicuousness and nectar production are similar in females and hermaphrodites. Results showed that the reflectance properties of green-phase flowers sharply contrast 'orange' tree bark, their natural visual background, rendering them more conspicuous to the avian eye than red-phase flowers. Green-phase flowers also produced more nectar than red-phase flowers as an honest signal of rewards. Similar results were observed in both female and hermaphrodite plants. Overall results provide an example of reversed flower-background colour contrasts, with 'reddish' hues being incorporated into the visual backgrounds of floral displays rather than being associated with the flowers themselves. They also illustrate that flower conspicuousness can serve as an honest signal of nectar rewards to pollinators.

The pathway to awareness of Light Pollution in Aotearoa New Zealand.

Butler S[1]
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Biography:
Steve Butler FRASNZ

Leader Dark Skies Group, RASNZ

Board Chair Aoraki Mackenzie International Dark Sky Reserve

From at least the early 1980s in New Zealand the potential for impact from outdoor artificial lighting was recognised. This was particularly related to protecting astronomical research at the Mt John Observatory in Tekapo. Early lighting restrictions applied then are still relevant today across a much wider areas of concern. This talk will describe the work of increasing awareness of light pollution in New Zealand legislation, standards, decision makers and researchers.

Water bird surveys in the upper Waikato River and Lake Ohakuri and Lake Arapuni: 2012-2019

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[1]*Wildland Consultants,* [2]*Wildland Consultants*

Biography:
Chris Bycroft is a Senior Ecologist with Wildland Consultants based in Rotorua. He is currently Treasurer of the New Zealand Ecological Society and is a past President of the Society. He specialises in botany and avifauna surveys and has done many of the surveys for this project. Chris studied tussock grasslands in southern Aotearoa New Zealand in 1990s for his PhD. Since moving to Rotorua in 2000 Chris has taken a particular interest in geothermal systems. He enjoys visiting wild and remote places, particularly tramping and trail running.

Mercury NZ Ltd (Mercury) holds resource consents to operate the Waikato Hydro Scheme and is required to undertake five-yearly bird breeding surveys to assess wetland bird abundance and breeding success for riverine sections (Taupō gates to Lake Ohakuri) and the Arapuni and Ohakuri reservoirs. This work began in 2003 with surveys at various times of the year on eight occasions. This assessment reports on results of surveys since 2012, when regular surveys have occurred at the same time of year (early November) in 2012, 2017, 2018 and 2019. The survey work has shown the high importance of the lakes and river habitats for both riverine and lacustrine avifauna species and patterns of distribution between these major habitat types. The most common species observed during earlier surveys – māpunga/black shag, kawaupaku/little shag, kakīānau/black swan, mallard, and pāpango/New Zealand scaup - have remained abundant between 2012 and 2019. Collection of long-term data on the abundance of bird populations provides extremely useful information on trends in populations. The three consecutive years of surveys have been very useful, to enable testing for population changes for the most abundant water bird species in the study area. It has shown that the populations of all species assessed are reasonably stable. It has also illustrated key preferences for particular species for some of the independent survey sites. Some species have a higher abundance associated with riparian habitat (e.g. mallard and putangitangi/paradise shelduck), while others have shown a preference for lacustrine habitats (e.g. pāpango and kawau tūī/little black shag).

Genome-wide analysis resolves the radiation of New Zealand's freshwater Galaxias vulgaris complex and reveals a candidate species obscured by mitochondrial capture

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Biography:
Ciaran Campbell is a freshwater ecologist based at the Otago Regional Council. This study was part of his MSc thesis - "Phylogenomic relationships of the Galaxias vulgaris species complex".

Freshwater fish radiations are often characterized by multiple closely related species in close proximity, which can lead to introgression and associated discordance of mitochondrial and nuclear characterisations of species diversity. As a case in point, single locus nuclear versus mitochondrial analyses of New Zealand's freshwater-resident Galaxias vulgaris complex have yielded conflicting phylogenies. Our goal was to use genome-wide divergence patterns among these fishes to evaluate the potential role of mitochondrial capture in obscuring species diversity, and to understand how ancient and anthropogenic drainage modification explain this diversity. We generated and analysed a genome-wide dataset comprising 52,352 SNPs across 187 Galaxias specimens to resolve the phylogeny of this recent fish radiation. We conduct phylogenetic, PCA, STRUCTURE, and ABBA-BABA analyses to evaluate the evolutionary relationships of lineages in the context of natural and anthropogenic river drainage alterations. In addition to the 11 previously recognized freshwater-resident lineages, genome-wide data reveal a twelfth candidate species (G. 'Pomahaka'), apparently obscured by introgressive mitochondrial capture. We identify additional examples of mito-nuclear discordance and putative mitochondrial capture, likely mediated by geological and anthropogenic modification of drainage boundaries.
Our study bridges the gap, utilising genome-wide approaches for resolving freshwater biodiversity and revealing an obscured species. Genetic data also reveal the influence of drainage history on freshwater biodiversity, including the rapid divergence of recently fragmented fish populations, and the conservation genetic risks of anthropogenic translocations events.

Wilding conifers in a warming world: potential problems with persistent pines

Carlin T[1]
[1]*Scion*

Biography:
Dr Thomas Carlin is an invasion ecologist with broad interests across Quantitative Ecology, Invasion Biology, and Zoology. Tom received his PhD in Ecology from the Bio-Protection Research Centre, Christchurch, where he investigated the macroecological mechanisms that lead to weed invasions. At Scion, Tom is working on a range of projects including helping to prevent invasions of wilding conifer species, models of pathogen spread, improving urban ecological systems, and predicting soil properties.

Climate change will affect Aotearoa by increasing temperatures, wind speeds, and precipitation clines. Species distributions, dispersal, and life histories will undoubtedly be affected by this. Wilding conifers, which are an environmental disaster that already cover 1.5M ha of Aotearoa, are of particular concern. A further 7.5M ha of productive or iconic conservation land are threatened by invasion in the next 30 years, with invasion fronts likely to increase in speed due to stronger winds carrying seeds further and warmer climates leading to earlier, longer, seed rain events. These estimates do not account for potential climatic niche shifts, which could worsen their impacts. Wilding conifers have already experienced dramatic climatic niche shifts between their native ranges and Aotearoa, and could also shift their niche through time under climate change. Here we utilise current and future climatic data for Aotearoa, and future climate analogues (e.g. present-day Australia), to determine the climatic suitability of future environments. In contrast to earlier, more conservative, assessments, we find significant increases in the climatic suitability for wilding conifers under climate change – in particular threatening montane environments. Despite the high uncertainty, we use soil and biotic factors to identify areas of non-analogous climate at risk for which we currently lack climate suitability data. Current species distributions are a poor indicator of future distributions under climate change, and assessments must be aware of impacts from climatic niche shifts. Non-climatic factors, such as soil properties and the tree-root-microbiome, may have stronger influence on future conifer distributions in Aotearoa.

Pre-adaptation to antipodean climates allows invasive weeds to thrive in Aotearoa

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Biography:
Dr Thomas Carlin is an invasion ecologist with broad interests across Quantitative Ecology, Invasion Biology, and Zoology. Tom received his PhD in Ecology from the Bio-Protection Research Centre, Christchurch, where he investigated the macroecological mechanisms that lead to weed invasions. At Scion, Tom is working on a range of projects including helping to prevent invasions of wilding conifer species, models of pathogen spread, improving urban ecological systems, and predicting soil properties.

As climate change progresses, species will be exposed to novel climates. Understanding how species will respond under new climates is crucial from both a conservation and biosecurity perspective. In Aotearoa, invasive Rumex species readily grow in a range of novel climates which are far different from their native range. Such a climatic niche shift may reflect that Rumex have rapidly evolved to non-analogue climates, or that they possess pre-adaptations to environments outside of their native distribution. Determining between these alternatives is required to understand how quickly species will respond to climate change, if at all. Here we combine detailed macroecological insights with a large common-garden experiment across 2 growing seasons to understand whether introduced Rumex populations could outperform their native counterparts. We provide the first in-depth experiment of performance differences under both analogue and non-analogue climates in the introduced range, finding little evidence that Rumex have rapidly evolved to Aotearoa's climates. Despite large differences in performance between gardens, individuals from the native range showed similar germination, survival, and fecundity to individuals from the introduced range under all-climates. Likewise, no performance advantages were observed between populations grown in their home environment. We demonstrate that significant range expansion can occur through pre-adaptation in even globally widespread species – something thought to mainly occur in range restricted island endemics. Current species distributions are likely to be a poor indicator of their future distributions under climate change, and assessments must be aware of the potential to underestimate the potential impacts of even widespread species.

Palaeoecological and historical observations of kākāpo reveal shifting drivers of decline over 800 years

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[1]Manaaki Whenua – Landcare Research, [2]University of Auckland

Biography:
Jo Carpenter is a conservation ecologist who works on impacts of invasive species, plant-animal interactions, and limiting factors for birds. Recently, she has been studying the population dynamics of ship rats, the role of weka in NZ's past and present ecosystems, and how possums and rats affect fruit and flower abundance.

Understanding drivers of avian extinctions on islands is complicated when multiple drivers operate over extended timeframes. Here, we combine both Holocene palaeoecological data and historical observational data with probabilistic extinction-date estimators to illuminate the shifting drivers of decline for a flightless, New Zealand parrot species (kākāpō; Strigops habroptilus) as it approached near-extinction in the late twentieth century. By comparing the prehistoric (i.e., pre-1769) distribution of kākāpo with their historic (post-1769) distribution and layering this with data on deforestation and feral dog pack observations, we show that drivers of kākāpō decline shifted in time and space. In the South Island, forest clearance appeared to be the key mechanism of local kākāpō extirpation in the prehistoric Polynesian era (c. 1280 CE). However, in the North Island the scarcity of historic European era (1769 CE) kākāpō observations, even in intact forest, suggests other factors were operating, such as increased hunting pressure. European kākāpō observations did not generally overlap with feral dog observations, suggesting that feral dogs were unlikely to have been the key driver of decline for kākāpō. Based on multiple extinction-date estimators, we estimated there was a 32-70 year lag between kākāpō being lost in the South Island (predicted extirpation date 1991-2006) compared to the North Island (1936-1959).

Smile! You are on camera: use of trail cameras to estimate the abundance of a cryptic, unmarked species, Stewart Island kiwi/Rakiura tokoeka

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Biography:
I am an ecologist/zoologist with broad interests including animal behaviour, parasite-host interactions, anatomy, morphology, sensory biology, and conservation. My research is on island species, particularly birds, but also introduced mammals and charismatic land snails of Aotearoa - New Zealand. I have a passion for solving conservation problems, finding new biological wonders about animals, and working with technology.

Knowledge about abundance and population density of species is fundamental for ecological studies and species conservation. However, these estimates are difficult to obtain for rare and elusive species, particularly if they are unmarked. Trail cameras can be a suitable method for estimating abundance/density of cryptic species and are particularly valuable if they can be validated against known density populations or independent estimates of density. There are several analytical methods that can be applied to this kind of study, but few that are applicable to territorial, unmarked, and otherwise unidentifiable, group living species like Rakiura tokoeka (*Apteryx australis australis*). We used telemetry-based home ranges to assess the performance of camera trapping-based abundance estimates. We compared Royle Nichols, Binomial N- and Beta-binomial- mixture models using three estimations of effective sampling area calculated using two different methods, grid polygon and circular area. Density estimates from the different statistical approaches and effective sampling areas were assessed against independent estimates from territory mapping. We found that the negative binomial mixture model produced density estimates of Rakiura tokoeka that were not significantly different from those calculated using territory mapping while the other model's estimations were significantly lower. There was no significant effect of the methods for effective sampling area of the cameras on the model's results. This is the first study to trial the use of trail cameras for population estimates of kiwi and the results are promising.

Aotearoa in the dark? New Zealand's changing night-time environment

Cieraad E[1]
[1]*Nelson Marlborough Institute Of Technology*

Biography:
A quantitative ecologist, Ellen investigates the effects of human impacts on biodiversity. Her current research principally looks at the effect of light at night on the environment around us, and how we can minimise these impacts.

For much of evolutionary history, natural seasonal and daily cycles of light have provided stable environmental cues to guide the phenology and ecology of many plants and animals. More recently, the widespread use of artificial light at night in modern society has resulted in much of the earth's surface being exposed to night-time radiance well above these natural levels. In addition to effects on human health and reducing the intrinsic and amenity value of the night sky, a growing body of evidence indicates that this artificial night-time light disrupts the physiology and behaviour of many organisms, the abundance and distribution of species, and the functioning of communities.
Using a harmonized night-time light dataset from 1992 – 2021, the spatiotemporal pattern of artificial light at night was estimated across New Zealand. While often regarded as a dark-sky country, this analysis shows New Zealand's nightlight environment is rapidly changing. In many regions of New Zealand, the use of the intensity and extent of night-time light continues to increase (in some areas with as much as 10% per annum) at much faster pace than the global annual average of 2% per annum. New Zealand will need to stimulate change at several levels in order to minimise the impact of our 24-hour economy on the health of the environment around us.

Artificial light at night affects the interactions between plants and insect herbivores

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[1]Nelson Marlborough Institute Of Technology, [2]Leiden University, [3]Naturalis Biodiversity Center, [4]Netherlands Institute of Ecology

Biography:
A quantitative ecologist, Ellen investigates the effects of human impacts on biodiversity. Her current research principally looks at the effect of light at night on the environment around us, and how we can minimise these impacts.

Artificial light at night (ALAN) affects species' physiology and behaviour, and the interactions between species. Despite the importance of plants as primary producers, it remains poorly understood whether and how effects of ALAN on plants cascade through the food web. We assessed the extent to which ALAN of different spectra results in plant-mediated insect herbivory damage. In a 6-month field experiment, we exposed plants of differing palatability to three colours of ALAN and a dark control, and assessed plant traits (growth rate, leaf size, foliar density and thickness) and insect herbivory (represented by insect damage as loss of foliage to leaf-chewing insects, and gall abundance by phloem-feeding herbivory).

We found evidence for plant-trait mediated ALAN effects on herbivory for oak, but not for blueberry. In oak, ALAN of different colours changed the direction of relationships of insect damage with relative growth rate and with leaf thickness. Moreover, we found that the effects of ALAN on herbivory damage differed markedly between forest types within the same locale.

Our results show that continuous night-time light, as provided by street lighting around the world, affects food web interactions. The nature of these effects differed by species and appeared to depend on forest type and the light spectrum employed. These findings highlight the complexity of using spectral manipulation as a mitigation measure, as well as the need to consider ALAN in environmental management and planning, to limit the exposure and impact of cascading effects of artificial light at night on food webs and communities.

Plant volatiles-mediated interactions between introduced and native species

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[1]*College of Sciences, Massey University, New Zealand*

Biography:
Evans is a Chemical Ecologist, interested in plant-plant and plant-insect interactions. Evans completed his PhD study at Massey University, with his thesis focused on volatiles emission of invasive and NZ native plants and their potential impacts on other trophic levels. He now works for Horizons Regional Council as a Biosecurity Officer.

Volatile organic compounds produced by plants often modify the behaviour of receiving organisms (including other plants, animals and microbes). Despite that, the potential of invasive plants to disrupt chemical communication in native ecosystems is less-explored. In New Zealand, several introduced weeds, including *Calluna vulgaris* (heather) and *Cytisus scoparius* (Scotch broom), are highly invasive on the North Island Central Plateau. The limited information shows that these invaders, particularly heather, contribute to restructuring this unique ecosystem and decline in arthropod abundance. Still, the exact mechanisms aiding the invasion remain largely unknown. In this study, we explored the response of a common NZ native shrub, *Leptospermun scoparium* (mānuka), towards volatile cues of heather and broom and the impact of volatile cues of heather on a native beetle *Pyronota festiva* (mānuka beetle) and a biocontrol agent *Lochmaea suturalis* (heather beetle). In a semi-field experiment, we found variations in mānuka volatile profiles when paired with conspecifics, heather or broom, with a significant reduction in green leaf volatiles, sesquiterpenes and total volatile emissions when paired with heather. The host-searching and feeding behaviours of *P. festiva* and *L. suturalis* were investigated by offering their host plant, non-host plant and a combination of the two in Y-tube olfactometer and Petri dishes. *L. suturalis* showed high host-specificity in both Y-tube and Petri dish tests. *P. festiva* on the other hand, poorly discriminated between its host and non-host plant volatile cues, although it performed relatively well in Petri dishes, where other cues were present. The results suggest that *P. festiva* could have difficulties finding its host in environments dominated by heather. However, it is likely that upon landing on an unsuitable host, it may use other cues like vision, touch or taste to make feeding decisions.

A bird's-eye view of weed management in Aotearoa New Zealand

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Biography:

Andrea is a Senior Adviser in Pest Management at MPI and a Senior Research Officer at Massey University where she investigates the ecological impacts of invasive species at a multi-trophic level.

Aotearoa New Zealand has approximately 20,000 introduced vascular plant species; this is ten times more that its indigenous vascular flora of about 2,000 species. Many of these introduced plants have successfully established and become invasive, modifying the habitats they colonise and threatening native biodiversity. Therefore, weed management is a titanic task shared by central and local government, land managers, and landowners under national leadership of the Ministry of Primary Industries (MPI) and the Department of Conservation (DOC). While the MPI focuses on reducing risk by regulating the entry, propagation, and trade of potential weeds (e.g., through the National Pest Plant Accord), the responsibility for on-site control mostly falls to regional councils, and other land managers such as DOC, local iwi, or transport agencies (among others). The Biosecurity Act of 1993 gives Regional Councils the power to declare organisms (including weeds) to be Pests and to develop Regional Pest Management Plans (RPMPs) to achieve one of four management objectives: eradication, exclusion, progressive containment, or sustained control (site-led management is also a common management objective in RPMPs). This paper provides an overview of the current national weed management programmes led by central government and compares the sixteen RPMPs, identifying common and unique weeds to each region, differences and similarities in weed management objectives, and species overlap with national weed programmes and other pest plant lists. This 'bird's-eye view' highlights the successes, challenges, and opportunities for future weed management in Aotearoa New Zealand.

Population Genomics of the Threatened New Zealand Storm Petrel

Correll Trnka A[1]
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Biography:
*Anika Correll Trnka is an Honours student in Biological Sciences at the University of Auckland supervised by Dr Anna Santure and co-supervised by Prof Bruce Robertson at the University of Otago. She obtained her undergraduate degree in biological science, focussing on genetics, at the University of Auckland. For her Honours project, she examined population structure in the New Zealand Storm Petrel (*Fregetta maoriana*) to investigate the possibility that the New Zealand Storm Petrel has more than one breeding colony in New Zealand.*

The New Zealand Storm Petrel (NZSP; *Fregetta maoriana*), thought to be extinct for over 150 years, was rediscovered in 2003. In 2013, a single NZSP breeding colony on Te Hauturu-o-Toi (Little Barrier Island) was identified. Recent population estimates suggest there are currently over 1,600 NZSP, though no other breeding colonies have been found. Expeditions in 2021 to the Far North of New Zealand identified NZSP at sea over 300km away from Te Hauturu-o-Toi, indicating that another breeding colony may exist. Seabirds from distinct breeding colonies may genetically diverge due to high levels of philopatry and low migration rates. Blood and feather samples collected from NZSP in the Hauraki Gulf and the Far North were used to generate genomic data. This data was analysed with standard bioinformatics pipelines and software to investigate if individuals from the Far North are genetically differentiated from NZSP from the Hauraki Gulf, and if any individuals from the two locations are close relatives. Genetic divergence and a lack of close relatives between birds from the two locations could indicate that the NZSP from the Far North originated from another breeding site. However, analyses revealed that NZSP from the Far North and the Hauraki Gulf are not genetically distinct. Though no first-degree relatives were detected, possible second-degree relatives were identified between the locations. These results suggest that Te Hauturu-o-Toi may be the only NZSP breeding colony, though further research is needed to determine if other highly connected or very recently established colonies exist.

Research into feral pig eradication on Auckland Island

Cox F[1], Horn S, McInnes K, Macdonald N
[1]*Department of Conservation*

Biography:
Finlay has worked in conservation for the last 10 years focusing on animal threats to biodiversity. After initially working as a contractor delivering a variety of work from deer control on Fiordland's offshore islands to possum control as part of NZ's bovine TB eradication programme, Finlay was employed by the DOC in Southland. He has since been involved in a variety of animal control and eradication projects including the Million Dollar Mouse - Antipodes mouse eradication. Currently a workstream lead for DOC's National Eradication team, Finlay was involved in the Maukahuka Pest free Auckland Island project.

Since their liberation in 1807, feral pigs (Sus scrofa) have significantly impacted ecosystem health and processes on subantarctic Auckland Island (45 889 ha). Eradication of invasive species is often critical to restoration programmes and to prevent species extinctions. Eradication projects utilising multiple techniques have allowed feral pig eradications on large islands, though prolonged operations risk failure due to biological, logistical, and funding support factors. The pig eradication from Santa Cruz Island, California, set a precedent for a strategic rapid pig eradication. The same principles were emulated in a successful trial on a densely vegetated 951 ha peninsula on Auckland Island in summer 2018/19. Aerial hunting assisted by high resolution thermal camera technology reduced the pig population before the systematic delivery of ground team hunting with specially trained dogs removed survivors. The order and manner these tools were applied was critical in achieving confidence that the peninsula had been cleared of pigs, but also to reduce the inherent risk of failure by maintaining naivety in the population. Supplemented by other research, this trial has built confidence that an eradication of pigs from Auckland Island is feasible and has informed estimates of what it will take. The use of passive trapping, automated feeders, Judas pigs and division of the island into smaller fenced units has also been investigated and are additionally proposed to complement the hunting strategy. Emerging technologies such as the high-resolution thermal camera trialled here, and sodium nitrite toxicant will likely offer additional efficiencies.

Epiphytism: Life history of *Platycerium bifurcatum*

Cronin K[1], Burns K[1]
[1]*Victoria University Of Wellington*

Biography:
Tena koe,

My name is Kahurangi Cronin and I am a PhD student in the Kevin Burns lab at Victoria University of Wellington, my lab group is researching possible social responses in ferns, specifically Platycerium bifurcatum (Elkhorn fern).

I have completed an undergraduate degree in Biodiversity and Ecology and a masters in Conservation Biology.

My interests are climate change mitigation and animal and plant ecology.

It is commonly assumed that epiphytes rapidly succumb to mortality when they become dislodged from their host. However, the fitness consequences of epiphyte dislodgement have rarely been documented. Here, we compared the morphology and reproductive output of epiphytic and terrestrial (dislodged) individuals in *Platycerium bifurcatum*, a colonial, epiphytic fern from Lord Howe Island. Results showed that after colonies become dislodged, they alter their morphology plastically and suffer a reduction in reproductive output. However, most terrestrial epiphytes still reproduced prolifically after becoming dislodged, suggesting that falling to the forest floor may not be as disadvantageous as previously thought.

Ecological condition and use of greenspaces in primary schools

Cunninghame A[1], Stanley M[1]
[1]*University Of Auckland*

Biography:
Abigail Cunninghame is a MSc student at the University of Auckland. From a wider perspective, Abigails main interests are in human-nature connections and how best to conserve Aotearoa's biodiversity through communities. Her research aims to be the first step in understanding the potential primary schools have to share the land and the biodiversity load within cities.

As urban intensification continues to increase, urban greenspaces are critical for maintaining biodiversity and people's connection to nature. Schools are distributed throughout cities and in Aotearoa, often have relatively large greenspaces compared to surrounding residential areas. Therefore, school grounds have the potential to provide for and enhance native biodiversity, whilst facilitating positive relationships between children and nature. However, very little is known about the composition and use of school greenspaces in Aotearoa. Our research aimed to understand how primary schools contribute to urban nature through their greenspaces and whether nature on school grounds is valued and used by teachers in New Zealand. We assessed the size and quality of greenspaces in Auckland primary schools by measuring the quantity and quality of vegetation, and landscape context at 64 schools. We also investigated attitudes of New Zealand teachers towards school greenspaces and biodiversity using an online questionnaire. All schools had trees present on their grounds, however only 36% had a native forest patch and habitat quality was generally low. A third of schools also had one or more major weed species present, the most common being wooly nightshade, (*Solanum mauritianum*). Almost 90% of teachers noted positive behavioural changes in children after they had been playing in their schools' greenspaces. Common barriers to teachers improving school greenspaces included lack of time and funding, lack of leadership and governance and health and safety risks. Our results show huge potential for enhancement of biodiversity in schools through native plantings and thorough weed management.

The extraordinary story of an unassuming beetle: The past, present and future of the Cromwell Chafer Beetle.

Curtin E[1], Barratt B[2]
[1]*University Of Otago,* [2]*AgResearch*

Biography:
Emma Curtin is a PhD candidate at the University of Otago, working on ecological and agricultural effects of dung beetles. She received her MSc from Massey University, where she researched the Cromwell Chafer beetle. In April 2019, Emma founded and became the inaugural President of the Otago Entomology Society.

The Cromwell chafer beetle, *Prodontria lewisii*, is a critically endangered species, entirely restricted to an 81ha reserve in Central Otago, New Zealand. The Cromwell chafer is the only insect in the southern hemisphere with its own reserve. We describe the history of the Reserve and the chafer itself, from the discovery of the beetle in 1903, through to the Reserve's creation in 1983, and onwards to the research taking place today. The Department of Conservation manage the reserve and we describe how research informs management. Monitoring shows that despite threats such as dam building, introduced predators and habitat destruction, the population has remained relatively stable since 2001. However, new threats are emerging. Redback spiders, first seen on the Reserve in 2008, have been observed with up to 45 beetles caught in a single web. Research shows that filling in rabbit burrows deprives redbacks of habitat and can be an effective management tool. We examine other threats facing the beetles and describe studies undertaken to understand these threats, including current efforts to examine the genetic diversity of the species, with the aim of optimising diversity across the Reserve. We explore the possibility of translocating the Cromwell chafer. A study aiming to identify key plant and soil types for optimum larval and adult survival has shown that the Cromwell chafer is highly habitat-specific, requiring particular soil and plant combinations. We aim to provide a holistic picture of this species – its past, threats to its present, and hopes for its future.

The influence of the spatial distribution of microhabitat on invertebrate community composition in a New Zealand tussock grassland

Danuser L[1], Dickinson K[1], Barratt B[1,2], Whigham P[1], Curran T[3]
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Biography:
Lisa recently graduated with a Master of Science in Ecology at the University of Otago. She has a deep-seated love for the natural world and in particular grasslands. This love has only grown through undertaking her Masters and taking part in various monitoring projects. When she is not undertaking vegetation monitoring work she can be found rambling about mountains.

The spatial distribution and characteristics of woody species in natural grasslands, and their influence on the community composition of invertebrates is poorly understood. Although dominated by Poaceae species, natural grasslands are diverse and can have a prominent woody component. The presence of woody species in a grassland changes the micro-habitat available for other biotic assemblages including the invertebrate community. The research into New Zealand natural grasslands has been mainly focused on plant interaction studies. There have been relatively few studies on the interaction between plants and invertebrates and even fewer relating to the spatial relationship, in particular with regard to woody species.
This study, aimed to find whether there was a relationship between spatial distribution of shrubs and invertebrate diversity in a grassland recovering post fire disturbance. The study was conducted on the southern Old Man Range, at Mt Benger (45°34'35.6"S 169°15'24.9"E; 1180 m a.s.l.), utilizing previously established burned and unburned plots. The spatial distribution of the commonly occurring shrub *Veronica odora*, was recorded with a hand-held GPS device, and drone imagery of the site was retrieved for remote spatial analyses. Individual *V. odora* were sampled from the plots, and hand-sorted for invertebrates. The inter-shrub matrix was examined through turf samples which were placed in Tullgren funnels for invertebrate extraction. The invertebrates were then identified and community composition analyses, as well as spatial analyses, were conducted. This study results in a better understanding of the distribution of the invertebrate community in a grassland recovering post fire.

Climate Change and Fisheries Management in New Zealand

Davis J[1]
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Biography:
Senior scientist, Aquatic Environment Science Team, Fisheries New Zealand

Climate change presents a challenge for the management of New Zealand's wild fisheries and aquaculture operations. A range of impacts including chronic (long-term changes in climate conditions) and acute (extreme) events are affecting how much New Zealand can grow and harvest in the sea. Collaboration across all fisheries stakeholders and proactive communication of research and management measures will be core to sustainable management. Over the past few years Fisheries New Zealand has funded several research projects to develop our understanding of the impacts of climate change on our fisheries and identify key information gaps. Future research will focus on understanding the impact of marine heatwaves at a national scale and on focal fisheries. Linking forecasts of ecological change with agile decision-making processes and industry adaptation will be key to reducing the impacts of climate change on fisheries and protected species.

Effects of Fire History on Soil Fungal Communities in Tussock Grasslands

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Biography:
Nicola Day is a Lecturer in the School of Biological Sciences at Te Herenga Waka - Victoria University of Wellington. Nicola's research focusses on understanding how disturbances impact microbes in the soil, particularly fungi, and how this mediates recovery of plants in our unique and changing environment.

Soil fungi play a key role in ecosystem functioning and recovery of vegetation after fire. In other countries, fires have reduced soil fungal diversity and shift community composition, which can impact plant growth and recovery. These shifts occur because fire causes direct heat death of some fungi, but also indirectly impacts fungal communities via changes in soil texture, pH, and nutrients. Wildfire frequency and severity in New Zealand's tussock grasslands is projected to increase with climate change. How fires may impact our soil fungal communities remains poorly understood. We aim to investigate how fire history impacts soil fungal communities and plant-soil interactions. Our objectives are to: (1) compare soil fungal community structure under different fire histories, and (2) assess relationships between fungal and plant communities after fire. In one of the only experimental burn studies in New Zealand, a fully replicated design assessed aboveground impacts of burning in different seasons in 2001 in Deep Stream, Otago: spring, summer, or no burn (control). In spring 2019, a wildfire burned all plots. Soil samples were collected, and a vegetation survey was conducted in January 2020, nine weeks after the wildfire. Soil DNA was extracted and the ITS1 fungal barcoding region was amplified and sequenced using Illumina MiSeq. This research fills a gap in our understanding of the effects of fire history on soil fungal communities and plant-soil interactions in New Zealand's tussock grasslands, areas where we expect fire activity to increase under continued drying and warming due to climate change.

Social parasitism in plants

De Bock K[1]
[1]*Victoria University Of Wellington*

Biography:
In 2015, I started studying at the Catholic University of Leuven (KU Leuven) in Belgium. Here I did both a bachelor of Biology and a Master of Biology (track Ecology, Evolution and Conservation Biology). From August 2019 to January 2020, I studied at the University of Leiden as part of a University Exchange Program (ERASMUS) to specialize in tropical ecology and biodiversity (first year of my Master). I graduated Magna Cum Laude from my Master in July 2021. In May 2022 I started my PhD at the Victoria University of Wellington, New Zealand.

Social parasitism is a widespread phenomenon in many groups of social insect species but does it also occur in plants? Here, we investigated the effect of invasion of three different vascular plant species on the colonial, epiphytic fern *Platycerium bifurcatum*. Invaders include the epiphytic fern *Ophioglossum pendulum*, the epiphytic orchid *Dendrobium macropus* and the terrestrial fern *Microsorum pustulatus*. Results showed that invaders had a significant effect on both the reproductive output and density of the colony. We noticed significant differences between invader types, that either presented positive or negative effects depending on the nature of the invader. These results suggest that social parasitism is not just restricted to social insects as we initially thought it was.

Endemic moth fauna declines 82% over 60 years in New Zealand despite constant land use

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Biography:
Elizabeth recently finished her MSc thesis in early 2022, and is now working for Lincoln University on a DOC project measuring invertebrate biodiversity in the Te Manahuna Mackenzie Basin drylands. She will be presenting on her MSc research.

Recent evidence has sparked increasing concern of widespread insect biodiversity loss, often quoted in media as the "insect apocalypse". Despite growing interest, evidence to ascertain how insects are faring globally is scant, and as most insect abundance studies originate from Europe or North America, the situation in the Southern Hemisphere is particularly unclear. In Aotearoa New Zealand, long-term insect monitoring has been sparse, making determining threats to insect biodiversity and informing on best conservation protocols difficult. One long-term insect study, by entomologist Graeme White, measured moth biodiversity in the largely unimproved native tussock grasslands of inland Canterbury. White found a 56% decline in overall moth abundance from 1961 to 1989, possibly due to the encroachment of invasive browntop grass and subsequent decrease in native plant diversity. We investigated how moth abundance at Cass has changed since the end of White's study, by repeating White's light-trapping methods in 2020-21, using his original light traps and exact sites. Despite there being no apparent change in land management, we found a 57% decrease in total moth abundance since 1989 and an overall 82% decline from 1961 to 2021. The rate of decline of 3% per year has not changed across decades, showing that the decline is both large and ongoing. We will discuss which groups of moths might be most affected and possible drivers of this decline. Evidence of further declines in moth abundance have important implications for grassland management and insect conservation in New Zealand and globally.

The impacts of a warming climate and altered plant communities on soil respiration in globally distributed alpine ecosystems

Den Uyl J[1,3], Deslippe J[1,3], Classen A[2]
[1]Victoria University of Wellington, [2]University of Michigan, [3] Centre for Biodiversity and Restoration Ecology and School of Biological Sciences, Victoria University of Wellington

Biography:
I am a PhD student at the Victoria University of Wellington. I have a broad interest in field ecology and enjoy investigating complex relationships in natural systems and how they are changing as a result of climate change. As an American I am enjoying learning about new and beautiful ecosystems in Aotearoa.

Climate change is altering temperature and plant community assemblages worldwide with uncertain effects on carbon cycling. Soil respiration is a key component of the global carbon cycle and is sensitive to both of these factors. We utilize data from a globally distributed network of field experiments that deploy warming chambers and remove dominant plant species at high and low elevation alpine sites. We aimed to identify how changes in temperature, plant community, and their interactions may alter soil respiration.

Overall and across all sites, warming treatments significantly increased soil respiration by 33% ($F=12.76$, $P<0.001$). Respiration was 37% higher at low elevation sites ($F=7.56$, $P=0.006$) relative to high elevations. Neither dominant plant species removal ($F=0.02$, $P=0.901$) or the interaction between warming and species removal ($F=0.28$, $P=0.595$) significantly affected soil respiration. The temperature sensitivity of soil respiration was unaffected by warming and species removal treatments, but depended on elevation. Changes in soil respiration were highly correlated to temperature at high elevations, but uncorrelated to temperature at low elevations. Total soil percent carbon and nitrogen varied at high and low elevations and these factors explained the observed variation in the temperature dependence of soil respiration. Our results suggest soil nutrient stocks may modify carbon efflux from alpine ecosystems as the climate continues to warm.

Kahikatea Green Wheel – Waikato field trials and implementation

DENG Y[1], Denyer K[2], Briggs C[1], Tait D[1], Finnerty R[1]
[1]Waikato Regional Council, [2]Papawera Geological Consulting Ltd

Biography:
Yanbin Deng is a terrestrial ecologist at Waikato Regional Council. Yanbin's job involves providing expertise, and information on issues relating to terrestrial ecology and also evaluating data to quantitatively characterise the biodiversity "hot spots" in the Waikato region.

One of her current projects - 'Prioritisation of Significant Natural Areas (SNA) for Biodiversity Management in the Waikato Region', aims to better categorise the important ecosystems in the Waikato region. Yanbin is also working on the Biodiversity Indicator project for assessing the extent of native vegetation, forest fragmentation using Green Wheel tool, and protected native vegetation areas.

Kahikatea (*Dacrycarpus dacrydioides*) forest remnants provide vital core habitat and stepping-stones for native lowland fauna. However, their health and sustainability are threatened by introduced pests, edge effects, and intensification of pastoral farming. Dramatic reductions in the extent of kahikatea fragments have been observed in the Waikato region, with about 5433 fragments (totalling 3965 hectares) remaining, of which 73% are under 5 hectares in size.
Waikato Regional Council has taken strategic steps to encourage protection and restoration of these iconic forest fragments, including monitoring, research, financial incentives, education, and information. The council has mapped all remaining kahikatea fragments, with maps and restoration factsheets available online, and initiated stand condition assessments using the Kahikatea Green Wheel (KGW) tool, which ranks 31 characteristic attributes using a five-star rating system. This tool is designed to help restoration managers evaluate the degree to which the ecosystem under treatment is recovering over time. Currently, eleven kahikatea fragments (in total 104 ha) across five districts, have been assessed using the KGW, with 83% on private land. Different types of pre-human kahikatea fragments were selected to understand the kahikatea community structure dynamics due to human impact. The site ranking scores ranged from 19.3 to 28.8 (of a possible maximum of 35). During the site visits, we also took the opportunity to initiate investigation into observed kahikatea dieback. The KGW assessment results have been sent to key stakeholders including landowners, iwi, and territorial authorities, to help identify appropriate restoration/management activities to improve the resilience of their kahikatea forest fragments.

Optimising bait consumption by ship rats

Dent J[1]
[1]*Zero Invasive Predators*

Biography:
Jenny leads ZIPs Animal Behaviour Team and manages the research facility at Lincoln University where we conduct captive research trials with possums, stoats and rats

Conservation in New Zealand is reliant on successful deployment of aerial 1080 for large scale control of possums and rats. Despite this, most captive trials to date have focused on possums (*Trichosurus vulpecula*), and limited research is available for ship rats (*Rattus rattus*). As part of a larger study on bait aversion in ship rats, we observed that lure concentration in bait declined faster than suggested by prior research. This rapid decay of lure is likely due to the smaller size of rat specific operational bait (6g). Rapid decay of lure has implications for bait attractiveness and toxin masking, which can contribute to the incidence of sub-lethal consumption and bait aversion. Bait aversion is of particular concern for predator elimination projects, i.e. Predator Free 2050, where even low levels of survivorship can have large consequences for operational outcomes. Our current research aims to quantify the relationship between bait age and consumption behaviour in ship rats. Trials are being conducted using both orange and cinnamon lured bait. We hope that this study will inform the optimal bait storage timelines for rat focused operations, as well as providing insight into the mechanisms underpinning bait aversion behaviour.

Climate x weed interactions as drivers of change in alpine ecosystems

Deslippe J[1]
[1]*School of Biological Sciences and Centre for Biodiversity and Restoration Ecology, Victoria University Of Wellington*

Biography:
Dr Julie Deslippe is a Senior Lecturer in Plant Ecology and Deputy Director of the Centre for Biodiversity and Restoration Ecology at the School of Biological Sciences at Victoria University of Wellington. Her team focuses on understanding the complex plant-soil systems that sustain life on Earth, particularly in the context of global environmental change, such as land use and climate change.

Climate change and biodiversity loss are two of the most pressing issues facing humanity. Aotearoa's alpine ecosystems are places of iconic viewscapes, unique and endemic biodiversity, and significant cultural value, but they are at risk from multiple threats such as warming and weed invasions. Here I report our recent and ongoing work in Tongariro National Park focused on understanding the stability and function of alpine ecosystems to global change drivers. I will introduce WaRM, Warming and Removals in Mountains, a network of globally-distributed experiments that manipulate temperature and plant species composition at two elevations in 10 countries. I will illustrate that the direct and interactive effects of global change drivers are likely to be negative for alpine plants in Aotearoa, and explain how changes in weed density have the potential to feedback to climate through altered C-cycling.

Will foraging pollinators take greater risks in a warming world?

Devenish R[1], Painting C[1], Barnes A[1]
[1]*University Of Waikato*

Biography:
René Devenish is native of Cape Town, South Africa where she completed her undergraduate in Biodiversity and Ecology. She moved to New Zealand three years ago and has recently completed her Masters in ecology at the University of Waikato.

The energetic trade-offs between predation-risk and foraging have been well studied across many animal taxa, including insect pollinators, showing that predation is an important driver of foraging behaviour. However, temperature is also likely to play an important role, especially in ectothermic animals, due to its influence on metabolic rates. With increasing global average temperatures, it is imperative to understand how warming interacts with other factors such as predation risk to alter foraging behaviour of pollinators and their ability to provide vital pollination services. In this study, we ran a series of behavioural trails under laboratory conditions to test if insect pollinators increase foraging at higher temperatures to make up for increased energetic demands. Further, we test if pollinating insects show a smaller reduction in foraging at higher versus lower temperatures under simulated predation risk (i.e., if they are more risk-prone at high temperatures and more risk-averse and low temperatures). Our results showed that pollinator metabolism and foraging behaviour increased with temperature in the absence of predation risk. We also found that all species foraged less when predators-risk was included, but were more likely to continue foraging at warmer temperatures (more risk-prone). Our study demonstrates how warming temperatures could cause pollinators to increase foraging rates in order to maintain their energetic demands, but potentially at the expense of increased predation risk. This highlights an important fitness trade-off for insect pollinators that could have significant consequences for pollination services in the future.

Volunteering and partnerships - understanding the options and boundaries of contributions from tourism and recreation actors in Protected Areas

Dinica V
[1]*Victoria University Of Wellington*

Biography:
Valentina Dinica is Associate Professor in Public Policy and Sustainability. Since 1999, she has been teaching on topics such as: governance for sustainability and resilience; environmental policy; sustainable tourism; Protected Area governance; renewable energy policies; policy analysis: theory and methods; participatory policy processes. Valentina is a member of the Tourism and Protected Areas specialist group of the IUCN's World Commission for Protected Areas.
She was been the Convenor of the Environmental Policy and Politics Network of the New Zealand Political Studies Association (2017-2021). She served as member of the Steering Committee for the university's Distinctiveness Theme on Sustainability and Resilience.

Volunteering and public-private partnerships are viewed as key policy tools for reversing the decline of native biota and ecological quality. During the previous decade, the Department of Conservation (DOC) has implemented significant institutional and policy changes. These marked a transition, from a public service approach to biodiversity management in Public Conservation Lands and Waters (PCLW), towards a neoliberal approach whereby businesses and community organisations would lead ecological restoration works, while DOC would support and facilitate such work (Dinica 2017). Such transitions have not been altered after the 2017 elections.
This contribution presents the results of document analyses and interviews with 16 tourism concessionaires and community organisations regarding the opportunities and obstacles for such actors to deliver conservation services within PCLW. The interviews were drawn from a sample of 75 organisations that were sent invitations to participate in the research. The positive response rate was 21%.
Empirical analyses were guided by a conceptual framework developed by the author: the Persuade-Enable-Constrain framework, which integrates psychology, social psychology and public policy concepts (Dinica 2014, 2015). Empirical results distinguish between surmountable and unsurmountable obstacles, revealing the limited nature and magnitude of contributions such actors could bring. The framework's application reveals narrowly-framed policies by DOC, being exclusively concerned with enhancing the knowledge and motivations of business/community organisations. DOC policies have ignored constraining factors, such as legislation, resources and accessibility, next to conflicts of interest by tourism concessionaires. Recommendations are offered for more realistic policy goals and instruments.

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He poaka to matou taonga. "Those pesky swine!"

Dowsett C[1], Carr A, Lovelock B
[1]*University Of Otago*

Biography:
Claire, Ngāti Raukawa ki Waikato, is a PhD student investigating community values for wild pigs.

Claire's research contributes to the Marsden Project Good Nature, Bad Nature, and the Social Dimensions of Invasive Species.

Claire is supervised by Associate Professor Anna Carr and Professor Brent Lovelock of the University of Otago's Department of Tourism.

Wild pigs in Aotearoa, New Zealand, are of interest because of the substantial social discourse around their management and the variety of environments, productive sectors and social communities they impact, both as a pest species and a valuable resource.
This research investigates human values for wild pigs. What are Māori and local community interests and perceptions of wild pigs, and what cultural customs involve wild pigs?
Utilising a Kaupapa Māori approach and qualitative methods, Whanganui community members interested in wild pigs were invited to contribute as kaiāwhina (a representative or advocate) through semi-structured kanohi ki te kanohi interviews. The interview narrative was analysed using thematic analysis to identify the values and perceptions of kaiāwhina.
Initial assessment of the kaiāwhina narrative demonstrates an intergenerational relationship with wild pigs valued primarily as kai. As a product of kai, wild pigs impact multiple dimensions of human quality of life.
Knowing wild pigs are a pest justifies the ethics of wildlife harvest, and wild pigs act as a substitute in the absence of the ability to harvest indigenous species.
Some kaiāwhina actively manage sustainable wild pig populations on private and public land.
Wild pigs are valued as kai and perceived as taonga or wild resources.
This research identified the various values and motivations of community kaiāwhina with interests in wild pigs and may be helpful to inform conservation management strategies in the future.

Genomic inbreeding and its fitness consequences for the hihi, a threatened endemic passerine of Aotearoa New Zealand

Duntsch L[1], Whibley A[1], Bailey S[1], Brekke P[2], Ewen J[2], Santure A[1]
[1]*University Of Auckland,* [2]*Zoological Society of London*

Biography:
Laura Duntsch recently completed her PhD in conservation genomics of the threatened hihi at Waipapa Taumata Rau - The University of Auckland. She aims to understand and apply the latest conservation genetic tools in order to help bridge the gap between genomic research and threatened species management.

In small populations, inbreeding – the mating between close relatives – can exacerbate the loss of genetic diversity and may reduce the adaptive potential of the species. In addition, inbreeding can also prompt a reduction of fitness in a population, a scenario termed inbreeding depression. One of Aotearoa's species of conservation concern is the hihi (stitchbird; *Notiomystis cincta*), a threatened endemic passerine. In 1995, hihi individuals were translocated onto Tiritiri Mātangi island, and since then, a wealth of life history, pedigree and genetic data has been collected. Together with a recently developed genome assembly and 40k single nucleotide polymorphism (SNP) markers, these resources provide a unique opportunity to measure the impacts of inbreeding in hihi from the Tiritiri Mātangi population. Here, I present individual-based inbreeding levels and infer how severely the population has been impacted by the effects of inbreeding depression. I illustrate that inbreeding has a significant negative impact on juvenile survival, a key component of fitness. I also test for inbreeding effects across the genome, and find that inbreeding in three distinct regions of the genome significantly decrease fitness, suggesting a genetic load of deleterious variants in these regions. My work draws a clearer picture of the evolutionary potential of the species to adapt to future challenges such as climate change, and informs conservation management.

Exploring motivations and barriers to nature conservation on dairy farms

Elliot Noe E
[1]*Lincoln University*

Biography:
My research to date has focused on promoting biodiversity conservation and understanding human-nature relationships in landscapes heavily used and disturbed by people. Throughout my career, I have combined theories and methods from the social sciences and ecology, exploring people's worldviews, values and resulting behaviours to address conservation biology challenges.

Pastoral farming accounts for approximately half of Aotearoa's land area, which also contains over 25% of the country's remaining native vegetation – the highest proportion outside of public conservation land. Farm management has great potential to contribute to biodiversity conservation nationally by providing important reservoirs of biodiversity and corridors between them. Currently, however, many farming practices have significant detrimental impacts on the environment, and agricultural intensification has resulted in biodiversity losses worldwide. Dairy farms represent more intensive farming systems, where it is considered less practical to retain native vegetation. Studies have shown, however, that hedgerows and riparian strips can contribute substantially to biodiversity conservation in these systems. Given the patchiness of regulatory policy, Aotearoa is largely reliant on farmers voluntarily adopting biodiversity-supporting farming methods. Qualitative research is vital for understanding the nuanced contextual factors influencing farmers' decision-making and identifying the complex interplay of the multiple goals, values and motivations that farmers hold concerning their farms. Our research explores the goals, motivations and worldviews that inform dairy farm management and the relationship between these values and the adoption of pro-biodiversity management practices. Semi-structured 'go-along' interviews were used (asking farmers for a tour of their farm) to explore how farmers perceive their relationship with their land and their responsibilities for it, what they are doing to promote native biodiversity, and their motivation for adopting any pro-biodiversity farming practices, and to identify barriers to adoption of these practices.

Will kauri survive: Resilience of ancient kauri populations to the modern world

Elliott T[1], Bellingham P[1,2], Perry G[1], Burns B[1]
[1]The University Of Auckland, [2]Manaaki Whenua – Landcare Research

Biography:
Toby is a PhD student at the University of Auckland that is currently working with Kauri and Kauri Dieback. He did his undergraduate degree in 2015 at Auckland University before completing an internship in Costa Rica. After that he completed a PgDipSci and a Masters Degree at Auckland University, focussing on plant ecology. He is currently completing a PhD at Auckland University that is focussing on the population dynamics of kauri and the impacts of Phytophthora agathidicida (Kauri Dieback) on the dynamics and long-term stability of kauri populations.

Kauri (Agathis australis) is one of New Zealand's most notable tree species. However, its small remnant populations are at risk from multiple agents, the most pressing being *Phytophthora agathidicida*, causing kauri dieback disease. Little work has been conducted on the impact of *P. agathidicida* on the stability of A. australis populations, which requires further insight into the growth, death and fecundity rates of A. australis populations and the influence of *P. agathidicida* on these rates.

This study will first establish baseline measurements of vital (growth, mortality and fecundity) rates of kauri individuals across all life stages and evaluate the influence of factors, including kauri dieback and competition, on these vital rates. I will then use this vital rate data to create population models that allow us to analyse the stability of these populations and the life stages and vital rates most important for maintaining this stability. This research will aid in prioritising kauri populations or life stages within populations for management and will assess the risk that *P. agathidicida* poses to these important trees.

Light at night deters iconic invertebrates: male, but not female tree wētā avoid nocturnal illumination

Farnworth B[1], Innes J[2], Kelly C[3], Waas J[4]
[1]Tonkin+Taylor, [2]Manaaki Whenua - Landcare Research, [3]James Cook University, [4]Algoma University

Biography:
Bridgette Farnworth has a PhD in Behavioural Ecology and Conservation from the University of Waikato, New Zealand. Bridgette's research background involves assessing how rodent movement and foraging behaviour is altered by illumination, and how invertebrate activity changes in response to nocturnal lighting. Internationally, she has experience surveying for mammals off the coast of Tasmania and is an invited board member of the Australasian Dark Sky Alliance. At home in New Zealand, Bridgette has enjoyed working with a broad range of native species, though her favourite animal remains the rat.

Globally, artificial light at night (ALAN) has increased dramatically in the last two decades and is proposed as a major driver of invertebrate decline. However, the adverse effects of ALAN on many of Aotearoa New Zealand's native species remains unknown; in particular, little is known about terrestrial invertebrate responses to altered lighting regimes. We investigated how flightless orthopterans responded to artificial light at Maungatautari Ecological Island (Waikato, New Zealand). Based on their nocturnal behaviour, ecology and evolutionary history, we predicted that the endemic tree wētā (*Hemideina thoracica*) and cave wētā (Rhaphidophoridae) would reduce their activity under illumination. Experimental stations were exposed to three evenings under light or dark treatments and wētā visitation rates were analysed from images captured on infra-red trail cameras set up at each station. Light significantly reduced the number of observations of cave (71.7% reduction) and tree wētā (87.5% reduction). In observations where sex was distinguishable (53% of all visits), male tree wētā were observed significantly more often (85% of visits) than females (15% of visits) and while males avoided illuminated sites, no detectable difference was observed across treatments for females. Sex could not be distinguished for cave wētā. Our findings have implications for the conservation of invertebrate diversity and abundance within natural and urban ecosystems that may be affected by light pollution. The increasingly prevalent use of light at night highlights the importance of lighting regulations for Aotearoa New Zealand's unique ecology and cultural heritage.

Non-human charisma and the New Zealand conservation system.

Fern S[1]
[1]*Otago University*

Biography:
Sophie has recently submitted her PhD at Otago University

The term "charismatic" is widely used to describe non-human organisms that receive greater attention than the writer believes they deserve. Additionally, although there is no shared understanding of non-human charisma, it has become accepted that there is a link between organisms that exhibit non-human charisma and greater conservation and research attention.

This talk presents two of the key findings of my PhD research. Firstly, it presents the results of an online survey of the New Zealand public that establish a link between non-human charisma and willingness to conserve. In this survey, respondents were "very" willing to conserve organisms that they had also rated highly on three of the elements of non-human charisma. This study also demonstrated that respondents were broadly in favour of the conservation of all species, although fish were the least favoured taxon. Interestingly, when respondents could identify native versus introduced species, they were more willing to conserve native species, even when the introduced species was charismatic.

Secondly, this talk presents evidence that New Zealand's conservation system shows the effect of non-human charisma in the allocation of conservation effort and funding and in the language used to justify these decisions. This talk provides conservation practitioners with a useable definition of non-human charisma that allows them to examine their practice for biases toward the charismatic.

A whole-genome approach to resolve the genetic structure of Antipodean and Gibson's albatross populations

Foote I[1], Chambers G, Debski I, Elliott G, Parker G, Rawlence N, Rexer-Huber K, Walker K, Ritchie P
[1]*Victoria University Of Wellington,* [2]*Department of Conservation,* [3]*Parker Conservation,* [4]*University of Otago*

Biography:
Imogen Foote is a PhD candidate at Victoria University of Wellington with a research interest in the application of genetic tools to understand populations, and how this knowledge can be used in threatened species management.

Although seabirds are a comparatively well studied group, a major barrier to their conservation is the taxonomic uncertainty that exists across many groups. For instance, albatrosses (family Diomedeidae) have been subject to several taxonomic revisions, but debate is ongoing. Genetic datasets have been used to inform albatross taxonomy, but only a handful of low-resolution genetic markers have been used, limiting the power to delineate species boundaries. Recently, genome-wide DNA sequencing has become more accessible, and this type of genomic data can greatly improve species-level taxonomic resolution.
The Antipodean albatrosses of New Zealand presently comprise two subspecies, the Antipodean albatross (*Diomedea antipodensis antipodensis*) and Gibson's albatross (*D. a. gibsoni*). Both taxa are highly threatened, due largely to mortality associated with fisheries bycatch, and the populations continue to decline. Long-term population monitoring has revealed several differences between them; when the sex is known they can be distinguished morphologically, they have distinct foraging ranges and their breeding seasons differ temporally by several weeks, yet based on current genetic data they are considered one Evolutionary Significant Unit (ESU).
We are presently assembling reference genomes for both taxa using Oxford Nanopore Q20+ chemistry. We are also generating genome-wide SNP data to determine the level of genetic differentiation between these two subspecies and estimate demographic parameters such as genetic diversity and effective population size for each taxon. The findings from this study should help to better define species and population units, inform conservation management and provide fertile ground for further conservation genomic studies of albatross.

Advancing invasive small mammal elimination in upland areas: challenges and opportunities

Foster N[1]
[1]*University Of Otago*

Biography:
Nick Foster is a PhD student at the University of Otago and a predator ecologist employed by Zero Invasive Predators (ZIP).

The South Island of Aotearoa New Zealand is known for its dramatic mountainous landscapes that reach high into the alpine zone. Initiatives to control or remove invasive small mammal species in these environments are confronted by an abundance of challenges, yet opportunities to advance how we approach this daunting task lay undiscovered and under-utilised. In this talk I summarise findings across several pieces of research that include new knowledge of the extents of the distributions of invasive species, how high-elevation landforms obstruct their movements and can be exploited as barriers to reinvasion, and how some species persist in alpine zones throughout winter while others move to lower elevations or otherwise alter their spatial utilisation.

Developing a low-impact population monitoring method for goldstripe gecko (*Woodworthia chrysosiretica*) in Bushy Park Tarapuruhi.

Friedel C[1]
[1]*Massey University,* [2]*Wildland Consultants*

Biography:
Caitlyn has completed her Bachelor of Science, majoring in zoology and minoring in ecology from Massey University in Palmerston North. She has also completed her Postgraduate Diploma in Science and Technology, majoring in Zoology from Massey University. She is currently doing her Master of Conservation Science at Massey University. Her research aims to develop a long-term population monitoring program that could obtain useful abundance and distribution data on the goldstripe gecko (Woodworthia chrysosiretica) in Bushy Park Tarapuruhi.

Predator-free mainland sanctuaries, are assumed to be havens for New Zealand's endemic lizard communities. Monitoring can be used to establish whether populations are persisting in these sanctuaries, however it is crucial to find an effective method to do so. This research aims to develop a low-impact population monitoring method that could provide useful abundance and distribution data on the goldstripe gecko (*Woodworthia chrysosiretica*) population in Bushy Park Tarapuruhi. Lizard tracking tubes were deployed across 14 different locations of the 89 ha sanctuary to test their effectiveness at monitoring the species. Pear baited trackka cards were replaced once a week for three weeks, and when geckos were detected, day and night searches were undertaken. Using these data we used bayesian modelling methods to calculate the probability of goldstripe detection by the lizard tracking tubes. Goldstripe geckos were detected in harakeke bushes, piles of fencing materials and agapanthus. We found that lizard tracking tubes were good at detecting geckos. The methods established during this study will be used to help monitor long-term trends in goldstripe abundance at Bushy Park and the results suggest it could be a useful method for monitoring a range of gecko species across other fenced sanctuaries.

Frogs, bogs and people: Both research and the community benefits from science outreach on Haida Gwaii, a remote archipelago in Canada

Gamlen-Greene R[1]
[1]*University Of British Columbia*

Biography:
Roseanna is a conservation ecologist who just finished her PhD at the University of British Columbia, Canada. She is currently looking for a job or postdoc in Aotearoa, her home. She is passionate about doing research that aids conservation, while at the same time working meaningfully with local communities, especially mana whenua. She uses a range of tools such as population genomics, species distribution modelling and ecological experiments. Come and say hi!

Societal benefits from science require community engagement. Increasingly scientists are required to work with the communities in which we do our research to achieve these benefits. But this should not be seen as an inconvenience; often research outcomes improve greatly from community involvement in research. It can be challenging and emotional work. There is no handbook on doing ethical and effective community engagement, as the right approach varies depending on the community. However, respect, humility, patience, and persistence can help. I will share some of my takeaways from science outreach and community engagement during my PhD research on amphibians on the remote archipelago of Haida Gwaii (British Columbia, Canada), home of the Haida Nation. I spent over six years studying the ecological interactions, genetics, and distribution of amphibians on Haida Gwaii - and building relationships with people. My work with the Haida Nation, schools, government, farmers, forestry companies, community groups, and the general public became integral to the success of my project. In this talk, I aim to bring these lessons home to Aotearoa.

Pāua. Restoring a Cultural Icon

Gnanalingam G[1,2], Bennett-Jones L[1,2], Brook A[1,2], Campbell D[1,2], Flack B[2,3]
[1]University Of Otago, [2]Coastal People Southern Skies, [3]Kāti Huirapa Rūnaka ki Puketeraki

Biography:
Gaya Gnanalingam is a lecturer in the Department of Marine Science, University of Otago and a researcher with the Centre of Research Excellence, Coastal People: Southern Skies.

Abalone are a prime example of a family of species (Haliotidae) subject to serial depletion worldwide as a result of fishing pressure. In Aotearoa, pāua (blackfoot abalone, *Haliotis iris*) are no exception with a number of local populations in decline. Where it was once possible to 'walk on pāua in low water' tangata tiaki/kaitiaki now say it is impossible to harvest pāua without being able to swim and dive. Pāua are taonga for a number of iwi and hapū around Aotearoa thus with stock declines and decreased access, there comes associated losses to community well-being, cultural identity, and connection to the environment. Building on more than a decade of research on pāua ecology and community led management in the East Otago Taiāpure, Pāua – Restoring a Cultural Icon, aims to assess multiple ways in which we can substantially increase the number and size of pāua on our reefs to increase resilience and the prospect of this taonga persisting into the future. In order to do so, the projecting is utilising a combination of ecological surveys, studies based on mātauranga, stock enhancement, modelling, and outreach. Here we will provide an overview of the work to-date, and the work to-come to restore this iconic species.

RELATIONSHIP BETWEEN PLASMODIUM INFECTION AND THE BEHAVIOUR RESPONSE AT HANDLING IN TIEKE (*Philesturnus carunculatus rufusater*)

Godoy C[1,2], Castro I[1], Howe L[1], Soto-Gamboa M[2]
[1]*Massey University,* [2]*Universidad Austral de Chile*

Biography:
Cristabel Godoy is a Chilean, a veterinarian and master in Applied Ecology from the Universidad Austral de Chile. Her master's research carried out altogether with Massey University, focused in evaluated different aspects of the presence of avian Plasmodium in a population of North Island tieke.

Different studies have shown that parasites can modify specific behaviours in animals to increase their own fitness. In the case of avian Plasmodium, the death of an infected vertebrate host by a predator leads to the end of transmission of the parasite. Therefore, a more proactive escape response when a bird is captured by a predator would improve the bird's probability of an escape, and thus increase its parasite's transmission chances. In birds, escape behaviour can be elicited through human catching and handling. In this study, we used a Bayesian approach to test how host infection status and infection intensity with avian Plasmodium was associated to the behavioural and physiological response of the male tieke (*Philesturnus carunculatus rufusater*) to the stressful situation of human handling in the field. Our results show that adult male tieke with a higher Plasmodium infection intensity displayed a greater frequency of 'distress calls, and escape behaviours such as time spent wriggling and with an opened beak during the handling. These results suggest that the Plasmodium parasite load rather than the infection status affected the behavioural response during handling. Our findings support our hypothesis that adult tieke infected with Plasmodium would show a more proactive response to handling than non-infected birds, which would manifest itself with a more intense escape behaviour. These results highlight the importance of considering parasite load in studies on host-pathogen interactions.

Tracking hedgehogs in the urban environment of the Wellington suburbs using GPS data loggers

Grayston K[1]
[1]*Victoria University Wellington*

Biography:
After years of volunteering and work in the Conservation sector, I returned to study to complete a Master of Conservation Biology. Currently I am completing a thesis on the Urban ecology of hedgehogs in the Wellington regions in completion of a MSc in restoration ecology.

There is limited research into the dispersal and territories of hedgehogs in New Zealand, and especially when it comes to the urban environment. Using specially designed CatLog data loggers that can be fitted to their back, I aim to track 20 hedgehogs – comparing 10 in 'predator free' Miramar to 10 in a western suburb. Here I look at the effectiveness and of using these devices in an urban setting that might impact their accuracy, as well as other limitations using VHF transmitters to relocate the hedgehogs for data collection.

Understanding the impact of LED streetlight conversions on flying freshwater insects

Greenwood M[1], Hogsden K[1], Whitehead A[1], Smith B[2]
[1]*NIWA,* [2]*NIWA*

Biography:
Dr Michelle Greenwood is a freshwater ecologist at NIWA in Christchurch. She has over 18 years' experience specialising in ecological and environmental analyses that support environmental decision-making, with a particular interest in freshwater macroinvertebrate ecology.

Artificial light at night is thought to negatively affect terrestrial and aquatic ecosystems and reduce night sky visibility globally. Across New Zealand, 370,000 streetlights (predominantly yellow high-pressure sodium (HPS) lamps) have largely been replaced by energy-efficient, blue-white light-emitting diodes (LEDs). While the economic benefits of conversion are significant (millions/year savings in operational costs), the potential ecological impacts of the conversion are unclear. Healthy urban waterways provide important ecosystem services and contribute to cultural wellbeing, but their health is declining globally. Ecological light pollution likely alters the behaviour of emerging adult aquatic insects and may contribute to poor ecosystem functioning in urban waterways. We investigated the potential ecological impacts of LED conversions on attraction rates to streetlights of the adult flying stage of urban aquatic insects during two experiments. The first quantified insect attraction to HPS streetlights and their replacement 4000 K blue-white LEDs in the Christchurch residential redzone. The second experiment investigated insect attraction to different LED streetlights: 1) commonly installed 4000 K blue-white LEDs, 2) lower colour temperature (2200 K) blue-white LEDs that emit less blue light and 3) a yellow LED that emits no blue light.

We use the results of these trials to discuss flying freshwater insect attraction to different streetlight types. We hope our results can assist with the design of ecologically-sensitive streetlighting. In general, lights that were brighter or emitted more blue light were more attractive to flying insects, however not all taxa responded in the same way.

Connecting with our coastal heritage

Greig K[1]
[1]*University Of Otago*

Biography:
Karen is a Co-Director of Southern Pacific Archaeological Research (SPAR), a research unit and consultancy in the School of Social Sciences, University of Otago. She holds a PhD in archaeology, and has worked in the heritage profession in New Zealand for over 20 years. SPAR researchers are working with coastal communities in New Zealand and across the Pacific to build capacity in heritage conservation and address threats from climate change.

Coastal heritage is a significant component of the coastal environment, contributing to community well-being, identity, social cohesion and resilience, and providing a unique source of information about human-environment interactions over the long term. However, coastal heritage is particularly vulnerable to change, whether from development, climate change, hazards or even adaptive measures. This paper considers how coastal heritage initiatives can contribute to the work of CPSS to connect, understand and restore coastal social-ecological systems and communities in the face of climate change.

Patterns of ship rat population recovery after aerial 1080 application: influence of treatment size, shape and geography

Griffiths J[1], Carpenter J, Kemp J
[1]*DOC*

Biography:
James Griffiths works as a research scientist for the Department of Conservation. He has broad research interests that include: weed and mammalian predator control, application of remotely sensed data to conservation management, and more recently, cost-effective lowland native afforestation.

Conservation of New Zealand birds often requires the suppression of introduced mammalian predators to or below density damage thresholds above which native bird populations decline. In montane forests, predator suppression is commonly achieved using pulsed aerial applications of sodium monofluoroacetate (1080) baits. However, predator populations can rebound quickly after aerial 1080 application and may not be supressed below density damage thresholds for long enough to allow vulnerable bird populations to recover.

Using data from the Department of Conservation's national rat tracking database and GIS-derived least-cost resistance surfaces we modelled rat tracking in 83 treatment areas over a three-year period after 1080 application. We sought to understand the influence of treatment shape, size and topographical context on patterns of rat population recovery after control.

Our analysis indicates that after 1080 application rat populations increased fastest near treatment boundaries where topographical features, such as mountains, lakes or rivers, did not impede travel. However, two years after control rat tracking peaked at 'easy to get to' places then declined. In remote topographically isolated places, after an initial lag, rat tracking rates increased steadily and 3 years after 1080 application were higher in these 'hard to get to' places than elsewhere or at other times. Thus, the duration of pest suppression may be augmented by increasing the size of treatment areas and exploiting natural barriers. Further research is needed to understand the management implications of high rat tracking in 'hard to get to' areas >2 years after 1080 application.

Mauri Ora Murihiku: Biodiversity Action on the Ground in Southland.

Hanley-Nickolls R[1], Harris A[1], Bulling P[1]
[1]*Environment Southland*

Biography:

Rose Hanley-Nickolls is a biodiversity community officer with Environment Southland. She has 14 years experience in both academic and practical conservation, spanning environmental economics, threatened species recovery, animal pest control, island eradications and community action from Iceland to the subantarctic islands.

Her current focus is on enabling people to carry out meaningful conservation action on their own land and through community groups.

Aotearoa New Zealand has lost over half of its indigenous cover since the arrival of humans. Outside of Te Rua-o-Te-Moko Fiordland and Rakiura National Parks - which cover half of Murihiku Southland - over 90% of wetland and 90% of indigenous forest in the region have been lost. These remnants represent up to sixty ecosystem types with a majority of threatened ecosystems found on private land. Under the Resource Management Act, regional councils have responsibility to maintain indigenous biodiversity. Environment Southland Te Taiao Tonga, with funding from the Ministry of the Environment, established the four year Biodiversity Action on the Ground project in 2020.

This $ 6.25 million project focuses on connecting science, practitioners and communities – providing ecological surveys to management plans to funded action. It aims to protect and enhance existing biodiversity in the fragmented landscape, increasing connectivity by centering action on threatened ecosystems on private land and unfunded public land. It aims to improve the quality of biodiversity on up to 300 000 ha in collaboration with Te Ao Marama Inc., with funding pathways specifically for rūnaka driven and supported projects.

This work is also identifying challenges to the scaling-up of conservation management required by the proposed National Policy Statement for Indigenous Biodiversity: under resourcing in technical professions, capacity within iwi, ongoing maintenance funding, hurdles for community group establishment, increasing participation by the less engaged, increasing avenues for covenants and the development of practical solutions on the ground.

The influence of seedfall, rats and weather on populations of New Zealand forest birds, expressed as multi-factor density impact functions.

Fea N[1], Hartley S[2], Griffiths J[3]
[1]Wildlands, [2]Victoria University of Wellington, [3]Department of Conservation

Biography:
Stephen Hartley is a lecturer at Te Herenga Waka - Victoria University of Wellington, and director of the University's Centre for Biodiversity and Restoration Ecology. He has wide ranging interests in ecology, conservation and restoration management of species and ecosystems.

Invasive mammalian predators are identified as primary drivers of more than half of the world's bird extinctions and are recognised as the main drivers of contemporary New Zealand forest bird declines. Density Impact Functions (DIFs), are employed by conservation managers to identify thresholds where the density of an invasive species results in unacceptable losses to native species However, environmental factors such as food availability and climate, may also influence the population trajectories of New Zealand forest birds.
Using monitoring and environmental data from four forest restoration projects from the Tasman and Wellington regions, we identified one univariate DIF and three two-factor DIFs to quantify population responses of particular forest bird species to changes in ship rat abundance, seedfall and weather. Seedfall had the greatest influence on forest avifauna dynamics, being a significant factor in all four DIFs. Kākā declined in detections the year after high seedfall. Population responses of three other bird species were moderated by interactions between seedfall and either rat abundance or rainfall. Rifleman detections were predicted to decline after moderate-to-high seedfall if this coincided with high rat tracking indices. Kererū and silvereye benefited from high seedfall in years where this coincided with high rainfall.
Endemic forest birds in New Zealand are facing a range of novel threats and identifying the most important drivers and the most sensitive species in the face of such challenges allows managers to target restoration efforts when and where it can make the most difference.

Growing a community's sense of "heritage": A former mataī forest from Ōtautahi Christchurch and its nitrogen status, AD 860-1430

Hawke D[1], Pauling C
[1]*Ōtautahi Isotope Research Unit*

Biography:
David Hawke has research interests in nutrient biogeochemistry and ecological data quality. His interests in nutrient biogeochemistry focus on landscape scale transport of nitrogen and phosphorus. His PhD is from University of Otago, supervised by the late Keith Hunter.

As in many places, heritage narratives in Ōtautahi Christchurch remain focused on colonial times. To extend this narrative, we examined subfossil mataī (*Prumnopitys taxifolia*) excavated at three sites along a 700 m arc during residential subdivision earthworks in the southeast of the city. Characterisation used $\delta^{15}N$, radiocarbon, and ring width measurements. Radiocarbon dates were 1222 BP (calibration median AD 856), 932 BP (AD 1148) and 545 BP (AD 1425). Ring widths (± SD) were 0.58±0.12 mm, half that of present-day mataī elsewhere, and an 8-year hiatus is tentatively identified as marking the AD 1257 Samalas eruption. The 545 BP site included a burnt stump, and stumps with cerambycid larval galleries that occur only in already dead trees. We conclude that the forest was highly dynamic due to periodic flooding, ending with fire in AD 1430±20 and inundation of the dead standing forest some years or decades later. Mean $\delta^{15}N$ values were +1.0±1.1‰, and consistent through time. The trees were therefore slow growing in an oligotrophic environment. We are now using traditional and social media and artists to disseminate the narrative of a former mataī forest "beneath our feet" through schools, community groups, and in public facilities.

The social-ecological acceptability of Russell lupin (as depicted on Instagram) and implications for management.

Hayes S[1], Lovelock B, Carr A
[1]*University Of Otago*

Biography:
Currently Brent is leading a Royal Society of New Zealand Marsden-funded project (2020–2023) exploring the relationships that different communities (e.g. tourists and the tourism industry, Māori, Pasifika, and recent immigrants and young people) have with invasive species in New Zealand and how this may affect future management of these species.

In many instances invasive alien species (IAS) eat, predate and spread, impacting native species and landscapes. In Aotearoa New Zealand, one such IAS - Russell lupin (*Lupinus polyphyllus*) - spreads quickly, smothers braided riverbeds, and provides shade for predators of often endangered birds including the Black stilt/kakī (*Himantopus novaezelandiae*). Owing to such impacts, there is in general an assumption of on-going homogeneity in public support for eradication of Russell lupin. However, this view may not necessarily be shared by all stakeholders. People and communities can develop attachments to introduced species, even some quite noxious ones, with IAS being incorporated into local identity or tourist itineraries. Our research aimed at better understanding the social/touristic value of Russell lupin. We did this by analysing how Russell lupin is represented - visually and textually - by Regional Tourism Organisations (RTOs) in their Instagram communications, and the reactions on the part of audiences to such communications. We found overwhelming evidence of Russell lupin being represented both by RTOs and audiences as a highly acceptable landscape feature that adds aesthetic value to the places where it grows (e.g., Lake Tekapo). On rare occasions where negative impacts were alluded to, these were embedded within a broader positive narrative underplaying the seriousness of the ecological threats. Our findings illustrate how, for some, Russell lupin is positively valued in Aotearoa New Zealand. In turn, this may complicate future efforts to control or eradicate this noxious weed. To help bolster public support for future targeted controls of Russell lupin, we recommend that organisations such as RTOs start actively re-presenting Russell lupin in ways that can more fully alert audiences – in particular tourists – to the damages this species can cause.

Light pollution: a unified global solution is needed for a global environmental problem

Hearnshaw J[1]
[1]*University Of Canterbury*

Biography:
Emeritus Professor of Astronomy, University of Canterbury. MA Cambridge 1972, PhD ANU 1972, DSc Canterbury 1995, FRSNZ 1995, FRASNZ 1995, MNZM 2017. Member Aoraki Mackenzie International Dark Sky Reserve board. Author of New Zealand Dark Sky Handbook 2021.

Light pollution from artificial light poses a global environmental crisis, comparable in severity to global warming by greenhouse gases, to plastics in the oceans and to industrial air pollution in many of the world's megacities. However, the dangers of light pollution are far less widely recognized, even though it is adversely impacting human health and the environment right now, as well as astronomical science.

A unified global solution is needed to address an urgent global environmental problem. There are many international agencies and organizations that can help tackle light pollution, and some are doing so already. But several more need to be lobbied. These include UNOOSA, COPUOS, IDA and IUCN (all of which are already engaged) and also WHO, ISC (the International Science Council), UNESCO and the OECD Environment Directorate. In addition, national academies of science in leading countries should be lobbied to approach their national governments.

New Zealand needs to adopt national legislation to curb light pollution, following the lead of countries such as France and Croatia who have already enacted such legislation.

The conservation status of giant wētā (*Deinacrida* spp.) in the South Island

Hegg D[1]
[1]*Independent Researcher*

Biography:

- MSc in Wildlife Management from the University of Otago

- Has worked on cave wētā (Rhaphidophoridae) and Orthoptera more broadly during the past six years, with three published papers on cave wētā taxonomy.

- Member of the expert panel that compiled the 2021 NZTCS assessment of the conservation status of New Zealand Orthoptera.

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 2021NZTCS 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.

Intervening in living ecosystems: How do we know we're helping?

Hellicar M[1,2]
[1]*The Cacophony Project,* [2]*Applied Innovation*

Biography:
Twenty-five years leading and shaping IT architecture while disrupting industries such as banking, media, and telecommunications. Now leading The Cacophony Project – a technology-focused not-for-profit conservation project designing and delivering cognified devices (including automated bird recorders, AI-enabled thermal cameras, traps that know what they're catching). Founder of Applied Innovation – a consultancy advising clients on the use of technology and data in conservation projects. Adviser to the Programme Management Group for Predator Free Banks Peninsula.

The Predator Free movement in Aotearoa is a leader in its field, taking on a challenge that has not been successfully achieved anywhere. Our approach to solving this immensely hard problem involves intentionally intervening in living ecosystems. Ecosystems that support a complex food web. We - humankind - have intervened here in the past with terrible consequences. It is our duty, our kaitiaki, to intervene again in a concerted effort to undo some of the damage we've caused.

But how do we know we're helping? If we can't measure the interactions that make an ecosystem thrive, we won't be able to understand the effect of our interventions. Our limited human senses are going to need help. We're going to need devices to measure much of this for us. Those devices need to capture, report, and interpret for us. They need to measure constantly and alert us instantly. They need to inform our interventions.

Re-balancing the ecosystems that support the lives of our taonga species is going to take a substantial investment. Targeting that investment correctly is critical to the success of our efforts. To inform the decisions we make, we're going to have to become experts at drawing insights out of the deep data that networks of sensing devices can provide.

Learning to listen to what the living ecosystems are telling us is the only way to ensure our interventions are beneficial.

Kataore: towards an iwi-led survey and monitoring programme for lizard biodiversity

Herbert S[1], Herewini H[2,3], Herewini S[2,3]
[1]*Centre for Biodiversity and Restoration Ecology, Victoria University Of Wellington,* [2]*Pukeroa Oruawhata Eco Warriors,* [3]*Te Kura Taiao*

Biography:
Sarah is currently a fixed-term Research Fellow at the Centre for Biodiversity and Restoration Ecology at the Victoria University of Wellington (VUW). Her career to date has alternated between ecological consulting, data analysis, and research. She recently completed a PhD at VUW that examined the feasibility of using habitat enhancement as a conservation strategy for New Zealand's endemic lizards. Her current research is focused on the design and improvement of monitoring programmes for cryptic herpetofauna using hierarchical modeling. However, she maintains broad interests in restoration and reconciliation ecology, population and community ecology, citizen science, conservation, and quantitative ecology.

Ecological and social systems are often interdependent, with major change in either system affecting the other. Biodiversity and ecosystem function are maintained by human activities in several ecosystems. Likewise, human health, wellbeing, identity, and the symbolic realms of culture are influenced by connection with the environment. Reptiles are culturally symbolic to several iwi and hapu of the Te Arawa confederation. For example, the ancestor of Ngāti Hinemihi is depicted with a lizard or tuatara on the pou of Hinemihi marae, and Ngāti Wahiao (Tūhourangi) gifted the name 'Ngarara Tuatara' to a hot pool in Whakarewarewa in the 1800s. These references hint at stories, histories, and relationships with the environment that are not currently well-understood. Te Kura Taiao and the Pukeroa Oruawhata Eco Warriors are Rotorua-based programmes that enable Year 7 to 13 rangatahi to learn and develop through hands-on conservation projects. These rangatahi discovered lizards inhabiting three sites in the rohe of Ngāti Hinemihi, Ngāti Whakaue, and Tūhourangi. This has sparked the co-design of a project with five aims: to (1) understand why reptiles are significant to Te Arawa peoples, (2) determine which lizard species are present at the sites, (3) establish monitoring to inform future adaptive management of lizard biodiversity, (4) facilitate the meaningful exercise of kaitiakitanga, and (5) identify opportunities to integrate educational outcomes from this programme with the Year 7-13 curriculum. We discuss our learnings thus far from the co-design process from the different, but complementary, perspectives of Mātauranga Māori and conservation biology.

Where are they landing? Mapping seabird fallout from artificial lighting in Auckland, New Zealand

Heswall A[1], McNaughton E[1], Miller L[1], Martin A[1], Cain K[1], Friesen M[1], Gaskett A[1]
[1]*The University Of Auckland*

Biography:
I am a seabird enthusiast and an aspiring sensory ecologist. Like many seabird researchers, I am a coffee addict who enjoys seeking the thrill and wonder of seabird research. I was born and raised in Brunei Darussalam, a small country full of animal diversity which inspired my passion for conservation. Typically you will find me either out in the field, in the lab, or at my desk studying seabirds and how they perceive threats in their environment. I am also a keen avian rehabilitator, volunteering and helping care for injured birds, including seabirds at BirdCare Aotearoa.

One of the most highly threatened animal groups are the seabirds. Seabirds are at risk from an array of threats including light pollution. Artificial light at night (ALAN) is a growing concern for seabirds as they become disoriented and grounded by the lights. Fledglings are especially susceptible to artificial lights. The Hauraki Gulf, a seabird hotspot, is located near Tamaki Makaurau/Auckland, which is Aotearoa New Zealand's largest urban city with considerable ALAN, and regularly documented events of seabird groundings. We aim to identify the locations especially prone to seabird groundings in the Auckland region, and test for correlations between this seabird fallout and ALAN. Using the Wildlife Medical Rehabilitation Database we mapped seabird fallout in Auckland between 2018-2021. We also mapped the seabird fallout against the predicted night sky brightness/night sky quality. We found that the greater the light pollution, the greater the chance of a seabird becoming grounded. Also, there were differences in groundings between the urban and rural areas of Auckland for the different species. For example, the Cook's petrel had the greatest fall-out in the urban areas compared to the other seabird species. This is potentially due the Cook's petrel fledglings crossing over the Auckland isthmus on their migration route to the Tasman Sea. Different species could have differences in their visual ecology and breeding locations which may influence light attraction. Greater awareness of seabird groundings from light attraction in Auckland is needed to generate a larger database of the location of seabird groundings across Auckland.

Environmental limits & targets in the new resource management system: how the science to policy process informs future research needs

Kavanagh P, Hodge F, Jones H, Howarth C
[1]*Ministry For The Environment*

Biography:
Patrick Kavanagh has been an employee at the Ministry for the Environment for more than 4 years, providing scientific input to a range of work programmes. Prior to joining the Ministry, Patrick was a postdoctoral fellow at Colorado State University and has a background in macroecology and biogeography.

Fiona Hodge has worked in a variety of teams at the Ministry, including being the biodiversity lead for Environmental Reporting and representing MfE on external biodiversity groups. Prior to joining the Ministry, Fiona completed an MSc in Marine Biology and held a range of positions with a biodiversity focus.

The Government plans to repeal the Resource Management Act and introduce new legislation, including a Natural and Built Environments Act. One tool within this new legislation is a set of environmental limits and targets, set to prevent degradation of ecological integrity and to protect human health. It is integral that robust science and evidence inform limits and targets if positive outcomes are to be achieved.

A broad range of evidence (including mātauranga Māori) is required to support limit and target development and associated policy decisions. For example, well-defined monitoring and reporting protocols, the nature of stress-response relationships, management option effectiveness, and an understanding of the resulting impacts (environmental, social, economic, cultural). This spread across values and disciplines requires comprehensive science and policy collaboration. Furthermore, scientific evidence is required in timeframes necessary to inform effective policy, and policy must accommodate some uncertainty.

Developing limits and targets involves identifying attributes that are important, suitable to be managed, and feasible for implementation. For the first iteration of national direction, our work will be constrained by the extent of science and evidence that is already available. However, this presents an immediate opportunity to prevent further degradation to the environment and sets a trajectory toward longer-term stewardship goals. An important outcome of our process will be a better understanding of the science and research needed to develop additional limits and targets. We will present the complexity and benefits of setting environmental limits and targets through science-informed policy and describe future science and research needs.

Overview of Pest free Auckland Island

Horn S[1], Broome K[2], Frank V[1], Cox F[1], Jacques P[1], Sagar R[1], Ware J[1], Hanley-Nickolls J[1], Leask E[1], MacDonald N[3], Kirby-Crowe M[1], Le Lievre M[1], Sagar R[1]

[1]Department Of Conservation, [2]Department of Conservation, [3]Department of Conservation

Biography:

Stephen Horn is the Manager of DOC's recently formed National Eradication Team. Stephen led investigations into the feasibility of the Pest-Free Auckland Island project between 2017 and 2021. Prior to that he was the project manager for the "Million Dollar Mouse" project that eradicated mice from Antipodes Island. He spent two years on Macquarie Island as a dog handler and Team lead as part of their rabbit and rodent eradication. Searching for warmer climates, he now lives in Invercargill

Eradicating remaining mammalian pests (pigs *Sus scrofa*; mice *Mus musculus*; cats, *Felis catus*) from Auckland Island will enable recovery and protection of unique biodiversity. Auckland Island (45 889 ha) is the fifth largest island in New Zealand. It is a key site for progressing the milestone of eradicating all mammalian predators from uninhabited offshore islands for New Zealand's Predator Free 2050 initiative (PF2050). We conducted a feasibility study over a three-year period to assess the eradication of all three pest species in one project. The assessment was based on three questions: why do it? can it be done? and what would it take to succeed? We proposed methods and used an evidence-based approach by undertaking large-scale field trials to test uncertainties and emerging technologies in-situ. We gathered data and evaluated methods against five established principles of eradication. The project is worthwhile and feasible but depends on specialised field teams and improvements to available tools. Eradication efficiency would be enhanced by realising emerging technologies. Three operations are required with specific sequencing and timing. A minimum two-year programme to establish infrastructure and logistics is a primary step. The project needs a large investment spread over eight to ten years to yield permanent and internationally significant benefits with low cost to sustain. The project has not been initiated but is a logical next step for PF2050 and is well supported by Ngāi Tahu runanga (local māori). The feasibility study has been valuable for exposing the project's scale, informing decisions makers, and focussing planning and future preparations on identified planning issues and dependencies.

Makarore Otanenui Catchment - A Recovery Site For Whio

Hufton R[1]
[1]*Aspiring Biodiversity Trust*

Biography:
Professional Ecologist and Ornithologist with over 20 years in the field of international ecology and environmental management. Employment experience includes the private consultancy sector, local government, and NGO's with specialism in threatened species work. Rachel enjoys connecting people with nature through implementation of science into realworld conservation. Rachel is a founding trustee of Aspiring Biodiversity Trust, working on threatened species programmes in the Makarora region of north Otago.

The South Island Whio (blue duck), *Hymenolaimus malachorhynchos malachorhyncho* is a globally endangered New Zealand endemic species, iconic of clear fast-flowing upland rivers and streams, mostly confined to high altitude segments of rivers in the South Island Mountain regions. It is the only member of its genus and has strong spiritual, cultural and historic connection with Māori. Whio presence is an indicator of riverine ecosystem health and completeness of ecological relationships within that ecosystem.
The national long-term goal under the existing Whio Recovery Plan (2009-2019) is: to maintain whio in the wild at sufficient numbers, in sufficient secure catchments so that the species transfers from the IUCN Category of "Endangered" to "Vulnerable".
There is currently nine recognised Whio Recovery Sites within the SI of New Zealand. This does not currently include or recognise the value of the Makarore region as an important site for remnant SI whio populations. This work outlines the value of Makarore as an accepted Whio Recovery Site, by providing an update on the current population status through results of comprehensive specialist survey effort and documentation of recent validated whio observations during dedicated Aspiring Biodiversity Trust conservation activities for multiple threatened species (2018-2022).
Since the establishment of ABT (2017) specialised protected species dog assisted surveys have been undertaken for whio. Additional to this, substantial observational and incidental records (2018 -2022) have been compiled to help develop a better understanding of the current population status and distribution within the region to guide appropriate and best use of resources to optimise recovery opportunities where whio are currently still, naturally residing. The locations identified are also important for additional species listed at the upper end of the NZ and Global (IUCN) Threat Classification System i.e. pīwauwau/ rock wren, kea, and mohua/ yellowhead.
Based on the results of the survey work undertaken and recent verified whio records it is estimated that there are up to 21 Adult Whio within the Makarore catchment region at present. This is promising as the late Peter Child (1981) identified 22 adults and up to 2 young birds from within the entire Mt Aspiring National Park.

Impacts of Rapid Ohia Death in forests of Hawaii

Hughes R[1], Friday J[2], Keith L[3], Perroy R[4]
[1]USDA - Forest Service, [2]University of Hawaii, Manoa, [3]USDA - Agricultural Research Service, [4]University of Hawaii, Hilo

Biography:
Dr. R. Flint Hughes is a research ecologist with the USDA Forest Service at the Institute of Pacific Islands Forestry located in Hilo Hawaii. His research has focused on investigating the impacts of invasive species in Hawaii and elsewhere, characterizing the patterns, dynamics, and controls on carbon stocks in forests, and understanding interactions between the recently introduced fungal pathogen, Ceratocystis, and Ohia dominated forests across Hawaii.

Two newly discovered diseases, together called Rapid Ohia Death, have been devastating forests of ohia (*Metrosideros polymorpha*) on Hawaii Island. *Metrosideros polymorpha* is Hawaii's most important tree, and forests dominated by ohia comprise half of all forests in Hawaii and 80% of the remaining native forests. The fungal pathogens responsible for Rapid Ohia Death, *Ceratocystis lukuohia* and *C. huliohia*, were first identified in 2014, although stand-level dieback caused by them was observed as early as 2010. Results from a network 250 of 0.1 ha monitoring plots across Hawaii Island show stand level mortality rates from Rapid Ohia Death ranging from none to 42% annually. Smaller diameter stands with stems <20 cm dbh exhibited lower average mortality (4-5%) than larger-diameter stands (12-13%). Because larger and presumably older stands tend to be structurally complex and diverse, habitat for other native plants will be disproportionately affected. On the other hand, mortality decreased in higher elevation and cooler stands and in drier stands, both of which tend to be more biologically diverse than low elevation, wet stands. No regeneration of ohia was observed in 80% of the plots, and almost all regeneration was in plots above 1,000 masl that are less heavily impacted by invasive weeds. Loss of larger ohia trees in low-elevation forests seems to have resulted in a significant decrease in populations of the Hawaii amakihi, a native honeycreeper largely dependent on ohia nectar. Remote sensing and field sampling studies have shown two to 69 times higher mortality in forests with high populations of non-native, feral ungulates than in neighboring forests that are fenced and have ungulates excluded. Since Ceratocystis is a wound pathogen, the mechanism seems to be that feral ungulates cause wounds which become infected. Forest managers are responding by increasing fencing and feral animal exclusion from high-priority forests and increasing bio-sanitary measures to reduce the spread of the pathogens.

Freshwater fish distributions on Rēkohu/Chatham Island

Ingram T[1]
[1]*University of Otago*

Biography:
Travis Ingram is a Senior Lecturer in the Department of Zoology and Deputy Director of the Ecology Degree Programme at the University of Otago. His research group works on various aspects of freshwater ecology and ecological genetics.

Rēkohu (Chatham Island) presents unique opportunities to study the ecology and distributions of native freshwater species. The relatively recent re-emergence of the island permits investigation of community assembly processes, while the absence of introduced fish species allows the study of native fish in a less impacted context. Our research group has been investigating the ecology, and genetics of freshwater species in the many shallow lakes of Rēkohu. The evidence so far points to a distinctive set of communities and to a critical role for the large intermittently closed and open Te Whanga lagoon in determining the distribution of lacustrine fish species.

Waitākere Ranges kauri population health monitoring

Jamieson A[1], Chew Y[1]
[1]*Auckland Council*

Biography:
Alastair Jamieson is Principal Advisor Biodiversity at Auckland Council where he is involved with a wide range of operational projects and policy initiatives for the management of indigenous biodiversity in the region. Alastair helped establish Auckland Council's kauri dieback surveillance efforts and provides technical advice for the current programme of work.

The impact of kauri dieback disease on the health of kauri ecosytems in Northern New Zealand from its causal agent *Phytophthora agathidicida*, has resulted in its classification as an Unwanted Organism under the Biosecurity Act. As part of its response, Auckland Council initially used a risk-based approach to kauri dieback surveillance by first undertaking aerial delimitation surveys of canopy ill-thrift, then applying targeted field surveys to understand spatial extent of disease symptomology in kauri stands and pathogen presence.
Auckland Council has now rescoped its kauri dieback surveillance and monitoring programme to focus on kauri population health and better deliver answers to key operational questions. We present a long-term kauri dieback disease monitoring framework that can be applied at multiple levels depending on the nature of the site. This framework represents a new model for surveillance and monitoring of forest pathogens in indigenous ecosystems.
We also present findings from the pilot of this new approach in Te Wao Nui Ā Tiriwa/ the Waitākere Ranges. The 2021 Waitākere Ranges Monitoring Survey set a baseline for monitoring kauri health and understanding risk factors that correlate with disease. This approach was co-designed with mana whenua and technical experts, and founded on epidemiological principles which is a novel approach for native plant disease outbreaks.
The kauri host population and sample frame comprising over 68,000 trees in the Waitākere Ranges parkland was mapped using a combination of HiRAMS, Worldview-02 and LiDAR remote sensing imagery to detect kauri trees >15 m high within the forest canopy. A total of 2140 randomly selected trees were surveyed and a subset of 761 trees were soil sampled for *P. agathidicida*. We present results on the baseline prevalence of *P. agathidicida* and kauri dieback and the risk factors that are potentially important in driving disease development and pathogen presence. This study provides a consistent cohort of monitored trees that can be re-measured to understand change over time. Results will be used to inform the ongoing and adaptive management of kauri dieback in the Auckland Region.

Insect Conversations: Engaging the Community about Insect Conservation

Jandt J[1], Merien M[2]
[1]*University Of Otago,* [2]*Canterbury Museum*

Biography:
I am a behavioural ecologist who specializes in social insect colony and foraging behaviour. I arrived in New Zealand in 2016, were I joined the University of Otago as a Lecturer. My lab investigates how environmental and social factors can affect behaviour. We are also committed to community outreach to promote floral diversity in urban areas.

Community engagement in citizen science can provide a variety and/or abundance of data on species distribution, activity, and ecology that would be difficult or impossible to collect using traditional scientific methods. Traditionally, conservation efforts have targeted large 'charismatic' fauna, but with community involvement and citizen science there is potential to engage people on animals who have typically remained under-represented. The ecological and economic importance of insect diversity, and the pressing need for conservation efforts are beginning to gain attention throughout Aotearoa; however, the data on changes in insect population are lacking. We will discuss how community engagement, social media, and investment into citizen science can increase awareness, data acquisition, and conservation efforts targeted at declining insect populations.

Who is Pollinating our Rare Limestone Plants in the Waitaki?

Milliken S[1,2], Johnson S[1], Lagrue C[1,2], Lord J[1]
[1]Otago University, [2]Department of Conservation

Biography:
Student studying master's in Zoology at Otago University

The rapid decline of New Zealand's rare habitats is one of the main threats to biodiversity and ecosystem services. Plants that only reside in these habitats are the main species under threat from habitat loss. A part of creating a conservation strategy for an endangered or threatened plant species is discovering how the species reproduces. Many plants use cross-pollination as their method of sexually reproducing. Pollination can lead to diversity in flowering plants and increases stability in a population. Most studies do not factor in pollination, if they do they do not identify the key pollinators. We are investigating the pollination of *Lepidium sisymbrioides* and *Gentianella calcis*, two nationally critical plant species found only in rare Otago limestone habitats. We sampled from two sites in Waitaki, North Otago. Observations of 10-minute increments per plant were conducted. Observed insects were caught, frozen and identified and pollen was collected from them 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.

Supporting biocultural connections in conservation translocations

Johnson F[1,2], Wehi P[3,4], Shaw R[5]

[1]School of Psychology, Te Herenga Waka - Victoria University Of Wellington, [2]Ngāti Kahungunu ki Heretaunga, Rongomaiwahine, [3]Centre for Sustainability - University of Otago , [4]Manaaki Whenua Landcare Research, [5]School of Biological Sciences, Te Herenga Waka - Victoria University Of Wellington

Biography:

Fin is a PhD and Clinical Psychology student in the Te Herenga Waka (Victoria University of Wellington) Kura Mātai Hinengaro (School of Psychology). His thesis explores Māori wellbeing through the development of a self-report survey measure. Outside of his study, he enjoys working as a research consultant, Māori youth mentor and research advisor. Generally passionate about research at the interface of Mātauranga Māori and Science, he is grateful to have been supported in branching out from Psychology to research his new favourite native bird, the Kākā. Fin looks forward to working as a clinical psychologist before eventually returning to teach.

Translocation is an important tool to safeguard species from decline, but translocation decision-making globally rarely takes into account relationships of place between species and Indigenous Peoples. We analysed geographical and archival sources related to the kākā (*Nestor meridionalis*), to investigate biocultural place-based knowledge of kākā ecology, movement, and human relationships, and consider how these might inform decision-making. Historical print archives (newspapers, magazines and journals) from 1842 - 1984 revealed a range of themes relating to kākā. Mapping place names revealed 'hotspots' of Māori names that reference kākā, with hills, streams and other landscape features bearing names associated with both kākā harvesting and ecology. Although some street names reflected human-kākā relationships, most were modern subdivision assignations, and were not informative of place-based biocultural relationships. Collaboration with local knowledge holders on a subset of place names demonstrated the importance of understanding the context of these names. Taken together, sources show temporal changes in the geographical distribution and recorded observations of kākā ecology could inform translocations. They also indicate that working in partnership with local communities is a critical component of understanding these relationships. We recommend that translocation guidelines support the relationships and place-based knowledge of Indigenous and other local communities. Translocations have the potential to restore species in and of themselves, but also biocultural connections and biodiversity.

Invasive species control selects for shy survivors

Johnstone K[1], Garvey P[1], Hickling G[1]
[1]*Manaaki Whenua Landcare Research*

Biography:
Dr Kyla Johnstone is a postdoc at Manaaki Whenua Landcare Research. She is interested the role of animal behavior, specifically, personality on responses to wildlife devices used for population monitoring, capture and control. As part of the Predator Free 2050 initiative, her postdoctoral research focuses on three species targeted for eradication (possums, rats, and stoats). She is examining personality as a mechanistic driver of avoidance/attraction responses to devices used for population control and as a predictor of survivorship during invasive species control operations.

The introduced common brushtail possum (*Trichosurus vulpecula*) is one the invasive mammalian species targeted for country-wide removal as part of the ambitious Predator Free 2050 program. Kill-trapping is an effective and economical method of possum removal in the early stages of a control operation. But as trapping progressively reduces the pest population, catch rates decline and cost per individual removed increases exponentially. Anecdotal reports have suggested a high prevalence of "trap-shyness" among survivors of trapping operations; if these individuals cannot be removed, eradication efforts will fail. Animal personality has shown to be an important source of variation in behavioral responses to live-capture devices, with capture biases often favoring bolder or more active individuals. This phenomenon could also apply to invasive species control, if kill-traps select for the most individuals as survivors. We present the key insights and challenges from a field experiment, where in collaboration with a local community group and DOC (Department of Conservation), a possum population was subjected to ~23 weeks of control using kill traps (Sentinel and Trapinator). Groups of possums were live trapped both before and at two points during the operation for behavioral testing. We tested the hypothesis that rather than being a random subset of the population, survivor possums differ behaviorally from the general population. Determining the influence of personality on survivorship is the first step in developing more effective methods to target recalcitrant individuals.

Conservation genomics of mohua (*Mohoua ochrocephala*)

Kann J[1], Dutoit L[1], Robertson B[1]
[1]*University Of Otago*

Biography:
Johanna Kann is a student at the University of Otago (MSc Zoology). She is interested in conservation genetics and how this can aid species management. Prior to her masters Johanna completed her BSc in Germany and worked at one of New Zealand's wildlife sanctuaries.

Translocation of threatened birds to predator-free offshore islands is a common tool in the conservation of Aotearoa's species. Island populations face several genetic challenges. Often established with few individuals, islands are prone to loss of genetic diversity via genetic drift and inbreeding due to small population size. Island populations may also be founded with birds originating from one source population, thus insular populations may not be genetically representative of mainland populations. This becomes an issue when managers want to use island populations as a source for future translocations. The mohua has been translocated to several islands over the past decades. Most island populations were established with birds originating from a single source. Island birds are now being used to supplement declining mainland populations, highlighting the need for genetic analyses of the island populations. Here were use genotyping-by-sequencing to generate genomic data (80,000 single nucleotide polymorphisms) for 183 birds. We investigate genetic diversity and genetic structure in island and mainland populations to understand which island populations might present the most suitable source for future translocations. Additionally, we examine mitochondrial DNA to resolve the phylogeography of mohua and further reveal valuable insights into female dispersal and historical abundance. Our results will aid the conservation management of mohua by characterising the genomic diversity across the range of the species and providing guidelines for future translocations.

Futile selfing revisited: kowhai inbreeding depression after 23 years

Kelly D[1], Robertson A[2]
[1]University Of Canterbury, [2]Massey University

Biography:
Dave Kelly has worked at the University of Canterbury since 1985, with a focus on bird-plant interactions. He retired from the UC payroll at the end of 2021 but doesn't seem to have stopped going to the office and doing research. He is particularly fond of long-term studies.

In an 11-year study of inbreeding depression in *Sophora microphylla*, Robertson et al (2011) showed that self-pollinated seeds were abundant but had low survival and growth rates, compared to outcrossed seeds. They said this was a likely example of futile selfing, and predicted that none of the selfs would survive to flowering.

Here we follow the survivors to age 23 and show that, so far, the prediction is correct. Of the 20 original crosses, all are still alive, whereas only 6 of the 20 selfs survive. The relative biomass advantage of the surviving crosses has increased from twice that of the selfs after 11 years, to four times as big after 23 years. Fourteen of the crosses (70%) have flowered, the earliest at age 16 years. So far none of the selfs have flowered, consistent with the prediction that production of selfed kowhai seeds represents futile selfing. Even if some selfs do eventually flower, their relative contribution to the next generation is – at best – very small and late.

Determining optimal monitoring strategies for translocated populations

Kenup C, Armstrong D
[1]*Massey University*

Biography:
Caio Kenup is a PhD candidate at Massey University, passionate about statistics and wildlife management, and try to find ways to combine both. Worked previously in Brazil on mammal translocations in the Atlantic Forest, and currently developing decision making tools for the management of endangered species.

Monitoring is an integral part of conservation practice. A large quantity of money and research is therefore dedicated to collecting and analysing monitoring data. From a pragmatic perspective, monitoring must provide sufficient information to allow good management decisions to be made. It should, however, be as cost-effective as possible, avoiding monitoring things that are unimportant or unchangeable. A useful tool for wildlife decision makers is Value of Information analysis. It explicitly quantifies improvements expected from reducing uncertainty, with those improvements measured in meaningful units such as money spent or numbers of individuals in populations. Monitoring has a high value of information when it can reduce uncertainty and this reduction is predicted to improve management outcomes. This study assesses how different types of monitoring can change management outcomes, using as an example a translocated population of Pateke. We estimated how different monitoring techniques and efforts would affect decision making for the population. This was achieved by simulating monitoring outcomes from different monitoring scenarios, how these outcomes would affect decision making, and ultimately the realized population growth of the translocated population and the costs of monitoring and management. Under the parameters of this exercise, it was found that a minimal level of fecundity monitoring was necessary to assure optimal decision making, whereas investing in more intensive fecundity monitoring or doing survival monitoring did not significantly improve decision making, wasting resources. We demonstrate that quantitative analysis of the expected gains of monitoring can help optimize resource allocation in conservation efforts.

Ecological insights, recent learnings and ongoing challenges

King C
[1]*University of Waikato*

Biography:

Carolyn Mary King FRSNZ is an English/ New Zealand zoologist specialising in mammals, particularly small rodents and mustelids. She joined DSIR Ecology Division in October 1971, and retired in 2018 as a professor in the School of Science at the University of Waikato. She recently celebrated 50 years of working on stoats, and still enjoys talking about them at every possible opportunity, especially to encourage local conservation groups.

For this keynote address, I have chosen (from among a host of possibilities) three examples relevant to PFNZ2050, to illustrate the three nominated topics. For me, the most outstanding ecological insights have come from our collective recognition of the huge importance of community and especially Māori engagement. For recent learnings, I could not go past the spine-chilling documentation over the last 15 years of the continuing decline of common bird species, and predictions of what will happen if we do nothing. Lastly, few ongoing challenges are as relevant to this session, and potentially contentious, as the basic philosophy of the PFNZ2020 programme.

Exploring the biocultural roles of introduced species in Aotearoa and internationally

Kitson J[1], Pryor Rodgers R[1], Tadaki M[2], Crowley S[4], Gibbs L[3], Reo N[5], Whaanga H[6]
[1]Kitson Consulting Ltd, [2]Cawthron Institute, [3]University of Wollongong , [4]University of Exeter, [5]Dartmouth College, [6]Massey University

Biography:
Jane Kitson is Ngāi Tahu ki Murihiku (Ōraka-Aparima, Waihopai and Awarua Rūnanga). Jane is an ecologist and environmental scientist with research interests in freshwater, mahinga kai and cultural monitoring. She is the director of an environmental consultancy that links values and science to support mana whenua in their environmental management aspirations and needs.

She is a board member of Ngā Pae o te Māramatanga: New Zealand's Maori Centre of Research Excellence Member, a member of the Guardians of Lakes Manapouri, Monowai and Te Anau, Te Waiau Mahika Kai Trust and the Rakiura Tītī Islands Administering Body.

In management and literature, introduced species are often viewed in binary terms as essentially undesirable features of ecosystems. This viewpoint reflects the negative ecological impacts of introduced species, and acknowledges that species introductions are power-laden social injustices as well as ecological phenomena. Binary thinking, however, ignores how human-environment relationships can be enhanced by introduced species, and fails to confront how status quo 'native' species management can harm those communities whose culture deeply roots them to place.

There has been limited research within Indigenous peoples' paradigms to examine introduced species and the roles they can hold within the contextually layered nuisances of connection to place – a whakapapa rather than a human-domination understanding. Within the limited research, some introduced species are identified as culturally impoverishing, facilitating, and/or empowering. In some circumstances, a single species could be all three – depending on the place-based context. Although this framing is useful – it still misses the multidimensional kinship elements that connect Indigenous peoples to nature.

As part of the five-year Fish Futures research programme, we aim to draw together relational and Indigenous thinking to develop beyond-binary understandings of biocultural relationships with introduced species. Here, we present an initial synthesis of ideas from our national and international research team, that explores fertile themes for justice-based, beyond-binary introduced species research and management.

Exploration of species-level fish biodiversity in Fiordland using eDNA highlights need for more reference data.

Czechowski P[1,8], de Lange M[2,3], Heldsinger M[4,5], Rayment W[5,6], Hepburn C[5,6], Ladds M[7], Knapp M[1,6]
[1]Department of Anatomy, University of Otago, [2]Biostatistics Centre, University of Otago, [3]Pacific Edge, [4]RPS Group, [5]Department of Marine Science, University of Otago, [6]Coastal People Southern Skies Centre of Research Excellence, [7]Department of Conservation, [8]Economist Intelligence Unit

Biography:
Paul is a biologist who writes code to recover genomes and metagenomes from trace DNA, as extracted from sub-fossil bones, museum specimens, and environmental samples (such as water and soils). Other current examples of his work include tracking invasive species along shipping routes, whole- and mitochondrial genome reconstruction of the extinct giant eagle Harpagornis moorei, as well as environmental DNA monitoring in the fiords of New Zealand.

Effective management of biodiversity requires regular surveillance of multiple species. Analysis of environmental DNA by metabarcoding (eDNA) holds promise to achieve this relatively easily. However, taxonomic inquiries into eDNA data need suitable molecular reference data, which are often lacking, particularly at the species level. We evaluate the impact of this data void in a case study of fish diversity in the remote fiords of New Zealand. We compared eDNA-derived species identifications against Baited Remote Underwater Video (BRUV) data collected at the same time and locations as eDNA. Furthermore, we cross-referenced both eDNA and BRUV data against species lists for the same region obtained from literature surveys and the Ocean Biodiversity Information System (OBIS). Concordance of taxonomies between the data sources dissolved with lowering taxonomic levels, most decisively so for eDNA data. BRUV agreed with local biodiversity information much better and fared better in detecting regional biodiversity dissimilarities. Thus, while eDNA analysis are well suited as a surveillance tool when locally generated reference data is available, we show that eDNA biodiversity surveys must be interpreted at the alignment level in the context of reference data quality and can be strongly misleading when local reference data is limited.

Impacts of Pleistocene environmental change on New Zealand birds

Lubbe P[1], Dussex N[2,3,4], Rawlence N[5], Knapp M[1,6]
[1]Department of Anatomy, University Of Otago, [2]Centre for Palaeogenetics, Swedish Museum of Natural History, [3]Department of Bioinformatics and Genetics, Swedish Museum of Natural Histor, [4]Department of Zoology, Stockholm University, [5]Department of Zoology, University of Otago, [6]Coastal People, Southern Skies Centre of Research Excellence

Biography:
Pascale Lubbe received her Master's in Quantitative Genetics from the University of Edinburgh in 2017 and is currently a late-stage PhD student at the University of Otago. Her work focuses on integrating genomic and spatial distribution data to examine how birds in New Zealand respond to climate change, both in the past and the future. She is particularly interested in the influence of habitat requirements and preferences on species' ability to buffer environmental change.

The impacts of Pleistocene climate change on both flora and fauna are of great interest to evolutionary biologists and palaeoecologists, especially on island nations such as Aotearoa New Zealand. Dramatic changes in environmental conditions, in particular the retreat of forest cover and the expansion of shrubland and tussock, initiated a period of settlement by new species, drove speciation, and caused phylogeographic structuring in many taxa. Research is ongoing into these effects, and large scale patterns for birds can be proposed: as forests fragmented, species living in them were bottlenecked and subdivided (as in kiwi); generalists maintained stable population sizes (as in kea); populations of aquatic species shrank in dryer Pleistocene conditions. These patterns remain untested, as many studies focus on only one or two species at a time.
Here we present demographic reconstruction using newly-sequenced whole genomes of sixteen endemic New Zealand birds across a variety of habitats. We highlight in particular the dramatic impacts on aquatic birds such as ducks, the cyclical responses of the alpine pīwauwau/rock wren (*Xenicus gilviventris*) and the forest-dwelling miromiro/tomtit (*Petroica macrocephala*), and the responses of generalists such as the weka (*Gallirallus australis*) and the kārearea/New Zealand falcon *(Falco novaeseelandiae*). Somewhat unexpectedly, forest birds show great variability in their patterns of change in population size, indicating that the impacts of climate change are complex and often species-specific, highlighting the need for both small- and large-scale studies.

Pleistocene environmental change and the "australification" of the New Zealand bird fauna

Knapp M[1,2], Lubbe P[1], Scofield P[4], McGlone M[5], Rawlence N[3]
[1]Department of Anatomy, University Of Otago, [2]Coastal People, Southern Skies Centre of Research Excellence, [3]Department of Zoology, University Of Otago, [4]Canterbury Museum, [5]Manaaki Whenua Landcare Research

Biography:
MIchael Knapp is a palaeoecologist and geneticist interested in the evolution and extinction of island species. He completed his PhD at Massey University before moving to postdoctoral positions at the Max Planck Institute for Evolutionary Anthropology in Germany and at the University of Otago. He has held a lecturing position in Molecular Ecology at Bangor University in Wales and is now Associate Professor in Biological Anthropology at the University of Otago.

New Zealand's unique biodiversity is the product of at least 55 million years of geographic isolation, supplemented by persistent transoceanic migration. Palaeontological and genetic evidence suggest most New Zealand avifauna has colonized from Australia. We synthesize evolutionary genetic studies to show a previously unrecognized clustering of divergence times in Australian and New Zealand bird species pairs, across the avian phylogeny at the beginning of the Pleistocene, around 2.5 million years ago. The timing coincides with major climatic and vegetation changes with the initiation of the Plio-Pleistocene glacial cycles. Recent anthropogenic impacts and environmental modifications are replicating in some important ways Pleistocene glacial landscapes, resulting in a new wave of avian "native invaders" into New Zealand.

The Rakiura Dune Restoration Programme: lessons learned from 21 years of operations, monitoring and research

Konlechner T, Hilton M[2]
[1]*School of Bioscience, University Of Melbourne,* [2]*School of Geography, University of Otago*

Biography:
Dr Teresa Konlechner is an Honorary Fellow at the University of Melbourne specialising in the ecology and geomorphology of coastal sand dunes. Her PhD from the University of Otago examined the invasion ecology of marram grass. She then worked at the National Centre for Coasts and Climate at the University of Melbourne on topics related to the use of nature for coastal hazard protection before returning to New Zealand in 2021. Teresa has published several papers on the dynamics and conservation of sand dunes in New Zealand. She has been involved in the Rakiura Dune Restoration Programme since 2005.

Invasive plants threaten Aotearoa's remaining active dune systems of high conservation value. Threats to the indigenous biodiversity, functioning and resilience of active dunes in southern New Zealand include marram grass (*Ammophila arenaria*) and tree lupin (*Lupinus arboreus*). The dune systems of Rakiura/Stewart Island are particularly important to the conservation of New Zealand's indigenous dune biodiversity, partly because of the size and diversity of dune environments and partly because marram grass and tree lupin were introduced relatively recently. However, biodiversity values are only retained because of active management through the Rakiura Dune Restoration Programme.

The programme commenced in 1999 when the Department of Conservation initiated large scale control of marram grass at Doughboy Bay. The programme has been sustained, expanded to encompass all other dune systems and tree lupin, and evolved with the goal of restoring geomorphic processes for the protection and conservation of the native dune flora and fauna over the intervening 21 years. This paper reflects on the lessons learnt from these 21 years of marram control. It examines the reasons for "success" including the vision and persistence of DOC, a commitment to monitoring, and the partnership between the University of Otago and DOC. We also consider the challenges and constraints which have arisen. This programme is now the largest (by area and expenditure) weed management and coastal dune restoration project in Aotearoa. The lessons learnt through this programme have applicability to other large scale weed eradication projects, as well as illustrating what is achievable through sustained weed control in other active dune systems of high conservation value.

Rare limestone plants – when translocation becomes the only solution

Lagrue C[1]
[1]*Department Of Conservation*

Biography:
Science Advisor Ecosystems for the Department of Conservation. Addressing knowledge gaps as well as Designing and testing management tools/approaches for the conservation of naturally rare ecosystems in New Zealand.
Background in parasitology, freshwater ecology, pest control and ecosystem functioning.

New Zealand limestone ecosystems consist of landforms such as cliffs, scarps and tors of rock compositionally dominated by calcium carbonate. They are scattered in small, isolated "islands", often less than 10ha in size. These ecosystems contain over 150 calcicolous plant species and counting. 95% are endemic and 73% have a total distribution of less than 10ha. More than half are threatened and a third are facing an immediate high risk of extinction.
Additionally, fertile limestone ecosystems are colonised by a high diversity of weed species, especially swarding grasses, which often dominate limestone areas. Exotic weeds outcompete native species adapted to sparse vegetation cover. Currently, very little is known about effective management of New Zealand limestone flora; there are no standard methods for ex situ propagation and translocation of threatened calcicolous plants.
We are developing standard nursery propagation and translocation protocols concomitantly with swarding grass control methods to recreate habitats suitable to native plants. The nursery component is testing different methods of germination, propagation and hardening of limestone species. The aim is to translocate plants back on site to boost existing but declining populations and/or create new ones. Paired with testing different approaches of weed control, our goal is to achieve long term success in native plant survival, growth, and natural recruitment post-translocation. Overall, the project is developing robust protocols for the management of rare limestone plants and designing SOPs for raising nursery plants fit to be translocated back in the wild, and thrive under natural conditions and reduced management input.

Ensuring the future of mahinga kai through Treaty Partnership

Langsbury H[1]
[1]*Ngaio House Consulting*

Biography:
I am an active kaitiaki within my takiwa and Aotearoa. I have a background in environmental management and are the senior Ecological Consultant for Ngaio House Consulting, a small business I operate from Otakou. An ecologist and conservationist with many years of experience promoting successful environmental outcomes. I am an active member of the Otago Conservation community, including Chair of the Otago Peninsula Biodiversity Trust, and a founding trustee for Wild Dunedin Festival and Predator Free Dunedin.

The re-introduction of the Buff Weka to their former range on the East Coast of Te Waipounamu, was initiated as a joint project by treaty partners, the Department of Conservation and Kai Tahu whanau ki Otago. This project is now into it's third decade of implementation, with many of the original goals of the project achieved, commitment to the partnership enabling this. Key outcome yet to be realised is the establishment of a self-sustaining mainland population, current populations are restricted to the islands of Wanaka and Wakatipu. The primary driver is mahinga kai and future sustainable harvest of Buff Weka. Project has been reviewed three times in the last 25 years. New challenges and opportunities provided by Predator Free 2050. Does the re-introduction of an apex predator impact existing ecologies that are out of balance? Does removal of an introduced predator sufficiently mitigate the impacts from the re-introduction of species that evolved alongside their target species?

We need to rethink ecosourcing if we want climate resilient ecological restoration in Aotearoa

Larcombe M[1]
[1]*Department of Botany, University Of Otago*

Biography:
I did my undergraduate and PhD at University of Tasmania, before coming to Dunedin to do a postdoc, and then take up a lecturing position. I am interested in understanding why different plants occur in different places, and how they have evolved through time. I have lots of specific interests including, conservation genetics and ecology, hybridisation and its impact on evolution, invasion biology, and restoration ecology.

Ecosourcing is a widely used seed gathering method for ecological restoration. It involves collecting seeds from plants that are more or less native to the restoration site. The rationale is that local populations will be adapted to local conditions because natural selection has shaped the population gene pool over many generations. This means that seeds from local plants will be finely tuned to the environment at the site, and should produce a robust, resilient restoration planting. Ecosourcing has garnered widespread support in Aotearoa from ecologists, conservationists, community groups, and government organisations alike. It is also widely used, with many councils and regional bodies promoting its use and facilitating its application. However, there are several reasons that ecosourcing might be counterproductive to long-term restoration efforts. Firstly, the rationale for ecosourcing implicitly assumes that the conditions that shaped the parental gene pool will be the same as future conditions at the site. Climate change is making this increasingly unlikely, in fact, modeling suggests we will see a major redistribution of plant climatic niches over the next 50 years. Secondly, the effects of inbred seed collected from small, remnant populations are likely to compound the adverse effects of climate change. Therefore, strict ecosourcing may actually produce maladapted restoration plantings that have low resilience to climate change. In this talk, I will discuss how such issues are being addressed in other parts of the world, and provide ideas for alternative seed sourcing approaches that could deliver climate change resilient restoration projects in Aotearoa.

Regional patterns in coastal Diptera communities with an exploration of issues important to coastal conservation

Le Grice R[1,2]
[1]*Canterbury Museum,* [2]*School of Biological Sciences, University of Auckland*

Biography:
My research interests include entomology, ecology, and animal behaviour. My current research focus is coastal Diptera (fly) species and communities in Aotearoa which was the topic of my PhD. I completed my PhD at the University of Auckland and worked as a postdoc at the University of Waikato for a year before taking up the role of Curator Natural History at Canterbury Museum earlier this year.

Coastal ecosystems are dynamic and can vary significantly with the local environment and geographically. Different regional conditions, both marine and terrestrial, may play a role in structuring coastal communities over large spatial scales. In addition, understanding the diversity and distributions of coastal communities in a manageable framework can be useful for conservation planning. Beaches are popular sites for recreation and industry, with high levels of anthropogenic use and modification of the coastal environment impacting these specialised species and communities. Here I aim to establish whether environmental conditions associated with both marine and terrestrial regions around Aotearoa|New Zealand are important in driving variation in coastal Diptera communities. Furthermore, I evaluate the potential for using these different regions for informing conservation management decisions, and assess the relative impact that removal of beach-cast wrack (marine macroalgae and other debris), and various land use modifications may have on these communities. Using extensive surveys of coastal Diptera communities, from around the three main islands of Aotearoa I have found that there is a highly uneven distribution of species richness with regions. The west coast is typically more depauperate compared to the east, and there is a significant difference in communities found in the most northern and southern regions. Absence of wrack is associated with a significant decline in species richness, but richness does not vary significantly with different types of adjacent land use. However, different regions and types of land use have a number of 'faithful' indicator species which are important in driving community variation.

The effect of long-term warming and plant species removal on an New Zealand alpine ecosystem

Leon I[1], Deslippe J, Classen A
[1]*Victoria University of Wellington*

Biography:
I'm a biologist with a Master's degree in Biological Sciences from Universidad de Los Andes in Bogotá, Colombia. My main passion and interest is plant physiology and ecology and understanding mechanisms plants use to cope with stressful conditions in the field. Right now my research is focused on investigating changes in plant community composition and carbon fluxes at the community and species level in alpine ecosystems.

Climate change threatens alpine ecosystems with faster rates of warming and changes in community composition due to plant invasions and local extinctions. We conducted a long-term field experiment to explore how warming and altered species composition may interact to affect ecosystem function. Here, we report the effects of seven years of warming and dominant plant species removal treatments on plant community composition at high and low elevations sites in Tongariro National Park. Measuring the percent cover of species annually at peak growing season, we evaluate changes in the relative abundance of subordinate species at both the species and functional-group levels. Warming, dominant species removal, and their interaction had generally negative effects on the plant community. Warming consistently reduced plant cover at both elevations, with a greater impact at the low than high elevation site (23% vs.7% reduction). Dominant species removal had significant but opposite effects on vegetative cover of subordinate species at the two sites; cover decreased by an average of 6.5% at the low but increased by an average of 8% at the high elevation site in all years. In the combined warming and dominant species removal treatment, patterns of vegetative cover were consistent with warming, with a 19% reduction at the low and a 5% reduction at the high elevation site. At the plant functional group level, we found large and significant losses in the cover of lichens across all treatments and elevations; between 28 and 40%. By contrast, at the low elevation site, warming significantly reduced the cover of grasses by 16%, but in combination with dominant species removal, warming increased it by 38%. These findings suggest low resilience of this plant community to warming and generally competitive effects of dominant plant species on subordinates in this alpine desert.

The Relationship between Polyploidy and Leaf Traits in New Zealand Angiosperms

Liddell L[1], Lee W
[1]*University Of Auckland*

Biography:
I'm a PhD candidate at the University of Auckland.
My thesis looks at the impacts of whole-genome duplication and polyploidy on the ecology and evolution of indigenous New Zealand plants, supervised by Bill Lee and Nick Matzke as part of the Marsden funded project "Whole-genome duplication in plants: what is the pathway to success?". Before starting my PhD I studied the biogeography of Metrosideros (Rata and Pohutukawa). I'm broadly interested in plant ecology, especially questions of biogeography, evolution, traits, and conservation.

The flora of Aoteara/New Zealand contain many genera that contain wide variations in chromosome number. These differences are the result of past whole-genome duplication events that have produced new polyploid lineages. Lineages with elevated ploidy levels include many of the most speciose plant genera in NZ (e.g. all ~124 NZ Veronica species are polyploid). Polyploidy can also reach extreme ploidy levels in NZ (e.g. sub-Antarctic Poa litorosa has 38 chromsome sets, the most of any grass). We might expect there to be adaptive advantages or unique ecological features common to NZ polyploids, however no consistent differences between species ploidy levels have been reported. Outside NZ, many studies looking at specific taxa have associated polyploidy with significant shifts in functional traits. However the nature of these trait differences varies widely between studies. I present the results of a large scale trait analysis of 60 native plant species from 10 angiosperm genera, representing a range of ploidy levels grown together under common conditions.

Pollinator's microbes and the fruit microbiome interactions

Lignon A[1], Jones E[1], Mas F[2], Dhami M[3], Kaiser C[1]
[1]Lincoln University, [2]Plant and Food Research, [3]Manaaki Whenua Landcare Research

Biography:
Currently a PhD student at Lincoln University funded by the Joint Graduate School - Food Transition 2050 scholarship.

Pollinators facilitate the transfer of pollen between flowers however, they may also transfer microbes while accessing nectar and pollen. This transfer of pollinator microbes helps shape the flower microbiome and additionally may play a part in the fruit microbiome. This microbial route of transmission between pollinator-flower-fruit has not been examined fully. This is a novel concept that has not been discussed in the scientific literature. How the different plant (floral and fruit) microbiome is assembled, the microbial transmission between pollinator to plant, whether microbes use the flower to fruit transmission route and how this may impact the pollinator-plant-microbe interaction will be explored.

Will ephemeral wetlands cope in a changing climate?

Lloyd K[1], Smith D[2]
[1]*Wildland Consultants Ltd,* [2]*Wildland Consultants Ltd*

Biography:
Kelvin Lloyd is an ecologist based in Dunedin with wide experience in vegetation and plant ecology in the lower South Island. He has mapped thousands of wetlands, sampled and monitored numerous wetlands, and provided expert evidence on wetlands.

Ephemeral wetlands are a seasonally wet wetland class found in closed basins, in climates where seasonal variation in rainfall and evaporation lead to ponding in winter and spring, with partial or complete drying in summer. They are most commonly found in inland areas of the South Island, but are also present in drier inland parts of the North Island. Ephemeral wetlands are a critically-endangered naturally uncommon ecosystem type, and provide habitat for numerous Threatened and At Risk plant species. Maintenance of ephemeral wetland habitats is thus important for the maintenance of indigenous biodiversity in Aotearoa. As the sustainability of ephemeral wetland habitat is dependent on patterns of seasonal rainfall and evaporation, they are at risk of significant change in a warming world, particularly if these rainfall and evaporation patterns change. Reduced rainfall could lead to reduced inundation and invasion by exotic plant species, while greater rainfall and less evaporation could lead to less fluctuation in water level, and a consequent reduction in ephemeral wetland habitat. We explore these scenarios based on monitoring of ephemeral wetlands in the Tekapo Military Training Area, Mackenzie Basin, South Island.

Trapping Stoats and Rats: Lure Preference and Optimising Lure Replacement and Trap Servicing Frequency

Long W[1], Hartley S
[1]*Remutaka Conservation Trust,* [2]*Victoria University of Wellington*

Biography:
Retired from paid employment, Winifred is a volunteer ecological analyst providing services to several conservation groups in the Wellington and Wairarapa regions. The analysis undertaken utilises the considerable volumes of data gathered through pest control activities and monitoring operations by these groups to provide insight into trends and the possible impact of pest control, or lack thereof, on flora and fauna in the area.

She has recently completed a Master of Conservation Biology degree at Victoria University of Wellington, focusing on ecological restoration in a New Zealand context.

Reducing predator pressure utilising manual kill traps is a mainstay of community groups in New Zealand in their efforts to provide an environment in which populations of indigenous species can recover and thrive. The presence of an effective lure is known to be beneficial, with hen eggs and ERAYZ frequently utilised as they have a relatively long life and are easy to use in the field. The question is; is one of these preferred by stoats and rats over the other? Also of interest are the intervals at which traps should be serviced and lures replaced; too long an interval may reduce the number of pest animals caught, but servicing and re-luring too frequently incurs additional costs and effort. The preference by stoats and rats between eggs and ERAYZ was examined utilising lure and catch data over the five years 2016 to 2020. For each species, a non-parametric survival model was fitted to the catch data, taking into account how the interval between re-luring and servicing a trap, lure type, and season affected catch rates. For stoats, average catch rates were low at 0.04 per 100 corrected trap-nights and there was little evidence to indicate that they are influenced by anything other than season of the year. For rats, there is a very strong indication that traps lured with ERAYZ have higher catch rates that those lured with eggs in most circumstances, and there is some evidence that re-luring and trap-servicing intervals may influence the probability of a catch.

Saturation or stimulation? The effect of mast flowering on pollinators

Lord J

Masting is characterised by irregular, highly synchronised mass reproduction, with one of the main benefits thought to be satiation of specialist seed predators. While masting plants are common in temperate ecosystems worldwide, few masting species are animal-pollinated, theoretically due to the disadvantages of pollinator satiation. However, in New Zealand masting occurs in a number of ecologically important animal-pollinated species, e.g. *Aciphylla* (taramea, speargrass), *Celmisia* (tikumu, mountain daisy), *Cordyline* (ti kouka, cabbage tree), *Phormium* (harakeke, flax). This talk presents data collected over 10 years of pollinating insect abundances and flowering intensities of masting and non-masting insect pollinated species at two alpine grassland sites in the Rastus Burn Recreation Reserve, Remarkables Range, Otago. Differences in flower visitor numbers between pairs of high and low flowering years were analysed for evidence supporting three scenarios: pollinator stimulation, pollinator satiation or pollinator diet switching either from non-masting to masting species or from non-floral to floral resources in a high flowering year. The system showed little evidence for pollinator satiation and patterns consistent with both types of diet switching differed between sites. The most supported scenario was that high flowering years for masting species also stimulate increased visits by potential pollinators to neighbouring non-masting species. This study highlights the importance of multi-year data for understanding New Zealand native plant-pollinator relationships.

Koi carp: The social dimensions of managing invasive coarse fish in the Waikato

Metcalfe E[1], Lovelock B[1], Carr A[1]
[1]*University Of Otago*

Biography:
Eru Metcalfe (Ngā puhi) was born in Timaru, raised for a couple of years in the Hokianga and then moved with his family to Twizel. Eru holds a Bachelor of Arts in Sociology and Anthropology, and a Post graduate diploma in Primary school teaching. Eru's research has a focus on enabling our future kaitiaki a means to navigate the world of protecting our unique flora and fauna.

Koi Carp (*Cyprinus rubrofuscus*) and other coarse fish present major problems in the Waikato region. The impact these fish have on the eco-systems of the Waikato rivers and lakes of reducing water quality and with impacts upon a range of aquatic macro-fauna has been well documented. This paper reports upon the social dimensions of koi carp as an invasive species in the Waikato region, and in particular pays attention to the perspectives of mana whenua and other stakeholders in the management and use of koi. Importantly, the Waikato awa (river) is an ancestor to Tainui, and recognition of this whakapapa (genealogical) connection is critical to how we perceive the place of koi today and their place in the future of management and use – which is challenged by a plurality of stakeholders, including coarse anglers and 'koi-hunters' who may or may not share the ambitions of mana whenua in managing the species. This research is based on in-depth qualitative interviews and conversations with those who have an interest in koi and other coarse fish in the Waikato. We discuss the findings in relation to the ongoing management of koi and associated invasive coarse fish in Aotearoa New Zealand.

The social dimensions of wild conifer and Russell lupin control - Te Manahuna Mackenzie Basin

Lovelock B[1], Ji Y[1], Carr A[1], Blye C[2]
[1]*University Of Otago,* [2]*University of Alberta*

Biography:
Brent Lovelock is Professor and Head of the Department of Tourism at the University of Otago. His research addresses human- nature relations. He is currently leading a Marsden funded project "Good nature, bad nature: the Social dimensions of invasive species in Aotearoa New Zealand"

Societal understandings of invasive species are important in the social contract to manage or eradicate such species. This study addresses tourists as stakeholders in the management of invasive plants, with a focus on wild conifers and Russell lupins in Te Manahuna Mackenzie Basin. Our sample of 238 tourists were surveyed on site for their understandings of invasive plants and attitudes to their control. We found significant differences between domestic and international visitors, and between visitors of different nationality and ethnicity in terms of their levels of ecological knowledge regarding invasive plants, their acceptance of invasive plants within the landscape, and appropriate methods of control. International visitors were more likely to accept invasive species and to report their value in terms of social (e.g. recreational and aesthetic) and economic ((e.g. firewood) dimensions and regarding climate mitigation. Chinese and other Asian visitors had somewhat lower levels of understanding and higher levels of acceptance of invasive plants than those of other nationality and ethnicity. However, some species of invasive plants, especially those with high aesthetic value (e.g. Russell lupins) were widely accepted by all survey participants, including domestic visitors, despite participants being provided with knowledge of their ecological impacts. There are implications for management in terms of the messaging that may be required for different visitor groups around invasive species control. The study also points to the challenge of developing support for the management of charismatic plant species such as Russell lupin that are now firmly located within the tourism domain.

The parasitic connection of *Cuscuta campestris* to conservation

LUNNISS Z[1], Bodmin K[2]
[1]*Dunedin City Council,* [2]*Department of Conservation*

Biography:
Zoe Lunniss is a practicing conservationist with a passion for parasitic plants. Zoe has recently begun a role as Biodiversity Advisor at the Dunedin City Council working with a range of stakeholders to provide advice and support on biodiversity objectives, policies and rules. Prior to this, Zoe worked with DOC to protect Waikato's Whangamarino Wetland from the Unwanted Organism, Cuscuta campestris.

Cuscuta campestris (golden dodder) is an annual obligate holoparasitic stem parasite belonging to the family Convolvulaceae. Considered a weed due to its prolific growth, habit, volume of seed production and impacts on produce yields*, C. campestris* has an international distribution and an extensive host range including many cropping and horticultural species.
C. campestris has the potential not only to invade crops and pasture plants within New Zealand but can also invade herbaceous wetland habitats impacting vegetation and wetland birds. In NZ it is designated an Unwanted Organism (Biosecurity Act 1993) and is listed as 'Progressive Containment' in the recent Waikato Regional Pest Management Plan 2022.
Present in NZ since the 1940's, *C. campestris* probably entered the country numerous times as a contaminant of imported seed. Although herbarium records show a sporadic distribution throughout NZ, DOC investigations revealed historic populations had not persisted and recent web-based 'finds' were mis-identified species. Wild populations of this parasitic weed were found to be restricted to a small number of wetlands in the wider Huntly area in the Waikato Region.
What started off as weed control in two DOC managed wetlands has turned into a biosecurity operation with the long-term aim of eradication. Along the way questions around ecology, weed management, public awareness, legislation, regulations, guardianship, recreation and conservation has led to a diverse 'team'.
The key to successful management of this species to date has been a collaborative approach, adaptive management and connections formed between multiple agencies and landowners, finding common ground and passionate people.

Animal-borne acoustic recorders can inform consistent abundance estimates based on passive acoustic monitoring

de Rosa A[1], Olsen D[3], Castro I[2], Marsland S[1]
[1]Victoria University Of Wellington, [2]Massey University, [3]Kiwitrack Limited

Biography:
Stephen Marsland is a professor of mathematics at Victoria University of Wellington. Stephen's research interests are interdisciplinary. His mathematical background is primarily in the theory and applications of differential geometry; recently this has largely been the analysis of bio-acoustic recordings. He leads the AviaNZ research project, which includes the development of freely-available software for the automatic recognition of calls from different species, and the estimation of call-rate abundance.

Passive acoustic monitoring is a popular method of wildlife surveying. With a single recorder the presence of a species in an area can be ascertained, while by combining simultaneous recordings, estimates of call rate abundance can be computed. However, to determine an estimate for the number of individuals requires some combination of knowledge of the call rate (which may itself be density dependent), reliable identification of individual animals from their calls, localisation of the call, and the proportion of silent animals.

In order to estimate the call rate we developed an animal-bourne acoustic recorder (ABAR) and mounted it on birds from two different high-density populations of North Island Brown Kiwi (Apteryx mantelli). These recorders detect only the calls of the animal carrying the recorder and others very close by. Together with the ABAR we placed acoustic recorders in the environment, thereby obtaining both individual and community level recordings.

For one of the populations, we collected data at two different times of year at one site, and also performed a dog sweep to provide an independent estimate of the number of birds present in the area. Several of the birds have VHF telemetry transmitters, and hence the dog sweep is analysed using a form of mark-recapture. We show that combining the two sound recording datasets provides more accurate statistical estimates of population abundance than using acoustic recorders alone, and discuss how to transfer ABAR-based knowledge of call rates from one population to another, together with its applicability to other species.

Growth Curve Analysis for the Monitoring of Kakapo Chicks

Salili-James A[1], Frean G, Digby A[1], Marsland S[1], Kakapo Recovery Team[1]
[1]*Victoria University Of Wellington*

Biography:
Stephen Marsland is a professor of mathematics at Victoria University of Wellington. Stephen's research interests are interdisciplinary. His mathematical background is primarily in the theory and applications of differential geometry; recently this has largely been the analysis of bio-acoustic recordings. He leads the AviaNZ research project, which includes the development of freely-available software for the automatic recognition of calls from different species, and the estimation of call-rate abundance.

The first line of monitoring of kakapo *(Strigops habroptilus*) chicks in nests consists of frequent weight checks. Each new weight provides an additional point on the growth curve for that individual, which is compared to an average curve based on historical data, matched for sex and food availability. Further monitoring and possible interventions are based on deviations below this average curve.

Potential issues with this approach include: relatively few chicks have fledged and therefore contribute to the average curve; the growth looks approximately 's'-shaped, and differences in when the `growth spurt' starts can falsely suggest unhealthy animals; hatch date needs to be accurately known. We therefore asked if there was a more robust method of analysis, and whether the process of identifying at-risk animals could be automated.

We present a tool that transforms the curves to more closely match one another using a smooth, invertible mathematical function known as a diffeomorphism. This has two principal benefits: we deal with curves rather than individual points, meaning that the precise time when measurements were taken does not matter as much, and we have a distance on the space of curves. This lets us define a more reliable average curve for each group, and compute differences between any individual's growth curve and that average. We built a machine learning classifier on top of these calculations. The result is a tool that was 95% accurate on independent test data, and that was made available via a webpage to rangers during the 2022 breeding season.

Seedling shade tolerance of eight invasive woody weed species

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Biography:
Dr Kate McAlpine has been researching environmental weeds at the Department of Conservation for more than 20 years, and represents DOC on several national governance groups, including the National Pest Plant Accord, the National Interest Pest Response, and the National Biocontrol Collective. Kate is also a council member of the NZ Ecological Society and facilitates the annual mentoring scheme for early career ecologists. Check out her weedy work stories on Instagram @katemcweedatwork

Woody weeds have negative impacts on natural ecosystems throughout New Zealand. Species that are shade tolerant at the seedling stage are particularly concerning because they can invade and persist in undisturbed native forest. We conducted a shade-house experiment to examine seedling growth and establishment responses of eight woody weed species which appear to differ in seedling shade tolerance: *Acer pseudoplatanus* (sycamore), *Ligustrum lucidum* (tree privet), *Ligustrum sinense* (Chinese privet), *Paraserianthes lophantha* (brush wattle), *Pinus pinaster* (maritime pine), *Prunus campanulata* (Taiwan cherry), *Pseudotsuga menziesii* (Douglas fir) and *Salix cinerea* (grey willow). Seedlings were grown from seed under seven levels of shade ranging from 0-99 percent shade. Seedlings were harvested 4-16 months later and growth, biomass allocation and establishment parameters were measured. For all species, specific leaf area (leaf area/leaf mass) increased as shade increased. *Prunus campanulata*, *L. lucidum*, *L. sinense* and *A. pseudoplatanus* seedlings were the most shade tolerant; seedling establishment increased, and above-ground biomass remained relatively steady as shade increased. These four species also showed a steady decline in root:shoot ratio with increasing shade. These shade tolerant woody weeds have potential to invade and degrade intact native plant communities. Conversely, *P. pinaster*, *P. lophantha*, *P. menziesii* and *S. cinerea* seedlings were more shade intolerant; above-ground biomass and seedling establishment both decreased as shade increased. These shade intolerant species are likely to be competitive in high light conditions but may be replaced by shade tolerant species as succession proceeds. These results will help land managers to predict where these woody weeds might invade and whether they are likely to persist.

The functional vulnerability of Aotearoa's woody plant communities to the loss of Myrtaceae

McCarthy J[1], Richardson S[1], Jo I[1], Bellingham P[1,2], Easdale T[1], Wiser S[1]
[1]*Manaaki Whenua – Landcare Research,* [2]*School of Biological Sciences, University of Auckland*

Biography:
James is a plant ecologist at Manaaki Whenua – Landcare Research. He is interested in patterns of species occurrence and abundance, and using spatial models to project these across large scales. He likes using these models to map patterns of important ecosystem functions, and make predictions for how these will be affected by events such as disease outbreak or large-scale climate change. Originally from Christchurch, James earned his MSc at the University of Canterbury before completing a PhD at the University of Queensland in 2017.

Myrtle rust is a fungal pathogen originally from South America that infects Myrtaceae species. After its arrival in 2017, two Lophomyrtus species and their hybrid were most commonly infected, but as time goes on infections on other species are increasingly observed (e.g. *Syzygium maire*), causing considerable concern for all 28 Myrtaceae species that are native to Aotearoa New Zealand (NZ). In the years following its 2010 arrival in Australia, myrtle rust continued to spread to new locations while also increasing its apparent severity on new hosts; a pattern likely to repeat in NZ. Using NZ national forest inventory plot data, we determined which forest communities are more functionally vulnerable to loss of Myrtaceae species. Using community-weighted functional traits, the functional vulnerability of each plot was quantified based on the extent to which co-occurring species may fill a similar ecosystem function as replacements for lost Myrtaceae species. Overall we found that plots were most vulnerable to loss of the successional species in the tribe Leptospermeae (kānuka and mānuka), but there are particular locations for almost all species where their loss would be detrimental, largely due to their dominance at that location and/or a lack of functionally-similar co-occurring species. Further, vulnerability was highest in Northland, and the east coast of both main islands. It is in these locations where myrtle rust is likely to have a greater impact in terms of disruptions to the functions these plant communities provide.

Cape pondweed control: three South Island examples

Mccaughan H[1]
[1]*Department Of Conservation*

Biography:
Helen McCaughan has a Master of Science degree and has worked in conservation and freshwater ecology for approximately 20 years. Helen has recently returned to the Department of Conservation (DOC) after spending one year working as a Biodiversity Officer for a Regional Council and five years working as a Freshwater Ecologist in the private sector. She has previously worked for DOC in various regions nationwide, as a Biodiversity Ranger and then a Freshwater Technical Advisor. She is currently working for DOC in a national freshwater role, with a focus on South Island freshwater biosecurity.

Cape pondweed (*Aponogeton distachyos*) is an introduced freshwater plant, with lily pad-like floating leaves and distinctive flowers that prolifically set viable seed. It forms large tuberous rootstock in the substrate of waterways and waterbodies. It grows vigorously in the warmer months and can dominate, forming a choking mat. This plant has limited distribution in much of the South Island and this presentation briefly discusses control that has been carried out at two sites in Canterbury (Hororata and Rangiora) and one site in Fjordland. These sites were chosen because of their high biodiversity values and/or distance from other known infestations. Notably this pest plant is not easy to control, due to its position in waterways, the thick waxy leaves being resistant to chemical penetration, and the tuberous root masses being difficult to remove completely. Control at the Fjordland site started last season by smothering the plant with mats, the Hororata site has had consistent hand weeding since 2019, and the Rangiora site has had attempts with chemical and hand weeding control over the past several years. There seems to be a lack of significant information available on this plant's features, weaknesses, and effective control methods, and work at these and other sites would benefit from filling such knowledge gaps.

Framework and visualization of linkages between landscape and soil characteristics in diseased kauri forest

McElvein A[1]
[1]*University Of Auckland*

Biography:
Annie is a masters student at the University of Auckland, expected to submit her thesis in February 2023. Annie is advised by Dr. Luitgard Schwendenmann and is a member of Ngā Rākau Taketake theme Risk Assessment & Ecosystem Impacts. Originally from USA, Annie graduated from UC Berkeley in 2019 with degrees in environmental science and GIS and has an interest in discovering practical applications of the two subjects. Outside of research, Annie spends most of her time rock climbing, tramping, and mountaineering.

Kauri dieback poses a significant threat to the ecologically and culturally significant kauri forests in New Zealand. To date, there has not been adequate investigation of the geospatial distribution and drivers of soil characteristics in kauri forest, and this research will attempt to fill that gap and potentially contribute to a better understanding of kauri dieback and its impacts on ecosystem characteristics. This study aims to quantify soil pH, bulk density, total carbon, hot water extractable carbon, total nitrogen, and hot water extractable nitrogen for 210 geotagged soil samples in Waitākere Ranges Regional Park. Each of those soil characteristics will be analysed geospatially for correlation with the following landscape characteristics: elevation, slope, proximity to roads, proximity to hiking trails, stand density, and forest wetness/brightness/greenness. Preliminary results suggest a higher organic carbon layer and nitrogen concentration in the center of the Waitākere Range, compared to the surrounding edges. Furthermore, a negative correlation between pH and bulk density in these samples has been identified, as well as a positive correlation between C and N. Potential geospatial factors explaining these patterns (e.g., stand density, forest structure) will be investigated. A product of this research will be maps of the Waitākere Ranges Regional Park built using random forest algorithms, illustrating any strong correlations between soil characteristics and various landscape features. The aim of this research is to provide a new framework to identify and prioritise areas at the greatest risk of kauri dieback infection.

The real-world magic of extendable ears

Molles L[1], Bedoya C
[1]*Atarau Sanctuary*

Biography:
I'm originally from Southern California, where I grew up in a neighbourhood bordered by three freeways and a river with concrete banks. I've always been interested in trying to get inside animals' heads, and have studied vocal behaviour in a range of bird species with the aim of understanding how they use their songs to communicate with friends, mates, and rivals. In more conservation-oriented projects, I have worked on translocations of kōkako, tūī, and roroa. I currently work with Atarau Sanctuary to develop acoustic monitoring tools, with a focus on identifying individuals based on their songs.

Animals communicate with one another (and often with themselves) to mediate interactions crucial to their successful survival and reproduction. Across a wide range of taxa, information - such as species, group, and individual identity, sex, reproductive status, and territory ownership - are broadcast acoustically. By eavesdropping on their conversations, we can learn more about animals' behaviour, monitor population dynamics and ecosystem health, and potentially boost the timeliness and efficiency of management interventions. And we can do it without bothering the animals at all, or even loitering in their habitats.

Use of passive acoustic monitoring techniques has burgeoned in the last decade, driven by rapid and ongoing advances in the capability and accessibility of both hardware and analytical tools. As an introduction to the Bioacoustics for New Zealand Wildlife Symposium, we will discuss where we're at with use of this technology in New Zealand, and place this in the context of efforts to improve, expand, and coordinate acoustic monitoring worldwide. We have some amazing advantages in New Zealand, including a relatively small and well-documented avifauna and a trove of existing acoustic data from work done by agencies and researchers around the country. We also face some substantial challenges, many of which are the focus of work by speakers in this symposium. We will highlight the potential we see for collaboration and future research to make the most of our high-tech extendable ears.

PF2050 beyond the birds: lizard population trends in a landscape of stoat, possum and rat control

Monks J, Wills H[1], Besson A[1]
[1]*University of Otago*

Biography:
I tipu ake au i ngā whenua o Ngāti Kahungunu. Kei Te Whare Wānanga o Ōtākou ahau e mahi ana hei pukenga i te mātai hauropi. E rangahau ana ahau ngā kararehe o Aotearoa kia whakamārama ai i ngā hīraunga mō te tiaki.

I grew up in the lands of Ngāti Kahungunu. I am a Lecturer in Ecology at the University of Otago. My research interests lie in applied ecology and conservation of terrestrial animals.

Landscape scale management of selected invasive mammalian predators detrimental to forest birds and bats is now occurring across Aotearoa New Zealand. In temperate southern beech forests, both predator irruptions and the timing of predator control is driven by mast seeding of the beech trees. Relationships between predators targeted in this control, other invasive mammalian predators and other native taxa, particularly lizards and invertebrates, are poorly understood. We monitored southern grass skinks in the Eglinton Valley, Fiordland from 2009 to 2020 alongside monitoring of predators (particularly stoats, rats and mice) and beech seedfall. We used these data to evaluate relationships between skink abundance and abundance of rats (targeted in predator control operations) and mice (which also prey on small vertebrates like lizards, but are not targets of current predator control operations). Skink abundance was negatively correlated with mouse abundance, but not correlated with rat abundance, suggesting that current predator control in place to protect vulnerable forest birds and bats is insufficient to protect, and may actually be detrimental to, lizard populations. Mice are significant predators of a range of small vertebrates and large invertebrates, yet little effort has been put into understanding their impacts or how to sustainably suppress mice to benefit populations of native species vulnerable to mouse predation. We strongly advocate for research into mouse impacts and mouse control in order to deliver integrated conservation management that benefits the full suite of biodiversity in Aotearoa New Zealand.

Conceptual Ecosystem Modelling as a management planning tool - useful or just a mouthful?

Moore S[1]
[1]*Department Of Conservation*

Biography:
Simon is a terrestrial ecologist in the Department of Conservation Terrestrial Science Unit based in Whakatū/Nelson. He has worked in restoration ecology, ecosystem and species management, statutory processes, and systems improvement for 26 years.

Ecological models can provide simplified demonstrations of the components of ecological systems and their interactions. Conceptual ecosystem modelling (Margoluis et al. 2009) provides a framework to steer biodiversity research and management requirements using diagrammatic representations. It has been used sporadically by the Department of Conservation to inform decision-making for ecosystem management units. These units have been selected to represent the best remaining examples of indigenous ecosystems in Aotearoa. Management prescriptions have been written for each ecosystem management unit with the aim of maintaining ecological integrity. Conceptual ecosystem modelling workshops have proven to be extremely useful in pooling knowledge of ecosystem management units and ensuring that goals, pressures, drivers and management actions are thoroughly tested.

A spatially explicit model for coupling urban growth with the enhancement of ecosystem services

Morris R[1]
[1]*Lincoln University*

Biography:
Richard Morris is an architect presently undertaking a PhD in agroecological systems design at Lincoln University. His research involves developing an ecosystem services-based design approach, supported by a spatially explicit modelling tool. Prior to undertaking a PhD, Richard worked for Medecins sans Frontieres in Afghanistan, co-founded a bamboo construction company in Myanmar and was involved in the design of high-end 'eco-resorts' in Southeast Asia. His interest in the ecological impact of these resort developments led directly to his present doctoral research.

CONTEXT:
Understanding relationships between nature and city, rural and urban, are central to reconciling urban development with the biosphere. Utopian approaches to this reconciliation, such as Garden Cities, do not square with the urgent agenda of climate adaptation. Practical, science-based, integrative strategies that couple urban development with the protection of ecosystem services (ES) are required.

OBJECTIVE:
This research proposes an ES-based design approach, using novel GIS-based spatial modelling informed by literature review, expert opinion and existing ES-modelling platforms. This approach is applied to the proposed design of a periurban residential development.

METHODS:
The site selected is the location of a contentious proposed large-scale residential development. Based on public submissions opposing the development, we use NVivo to determine the three most valued ES associated with the greenfield site. Literature review and expert opinion are used to quantify 'influence fields' specific to each of these most valued ES. We develop a new tool for ArcGIS Pro that uses these fields to assess ES performance under various configurations of natural and built-up land covers.

RESULTS AND CONCLUSIONS:
The most valued ES were food production, biodiversity and flood control. Our modelling approach suggests that an optimal spatial arrangement of natural and built-up land covers can enhance the three targeted ES, as well as addressing the demand for housing. The total number of houses is reduced if the developer's conventional suburban typology is used; these losses are mitigated if medium density housing approaches are adopted.

SIGNIFICANCE:
Our model provides a scientifically-based tool for developers, planners and designers to engage with greenfield sites. The ES-based design paradigm underpins a new framework to reconsider and re-imagine resilient urban, periurban and rural development.

Measuring Stoat Detectability with Poisoned Ship Rats

Mulgan N[1]
[1]*Zero Invasive Predators*

Biography:
Nick does mathematical modelling and statistics at Zero Invasive Predators. He has a PhD in theoretical and computational atomic physics and stochastic processes. He has done mathematical and statistical modelling for software development, power system modelling and economic analysis.

Stoats, one of the Predator Free 2050 target species, are widely considered difficult to detect and kill. However, secondary poisoning from aerial toxin operations is usually successful, at least as suppression, provided the rodent population is sufficient. Quantifying the detectability, g0, of stoats is difficult as the population size, N, is not known and the number of detections is a function of g0 N - a product that cannot usually be resolved. Stoats are also highly mobile and numbers fluctuate considerably with season, so that closure or constancy cannot be assumed.

A recent field trial of targeted poisoning by live caught ship rats that had been fed a lethal dose of 1080 was successful in stopping all local camera-trap detections. While promising in itself as progress towards an elimination tool, this result also gave an estimate of N, independent of the camera-trap g0. We can then separate the detectability for camera-traps, giving a value that is substantially higher than for other detection methods. This value of g0, in turn, allows us to estimate stoat population sizes in a variety of situations.

The Future of Wildlife Monitoring – Evaluating the Usefulness of Drone and Aerial Wildlife Tracking Methods

Muller C[1]
[1]*Massey University*

Biography:
Focus on wildlife tracking technology, including drone tracking systems, and development of new VHF receiver technology via Altitude Conservation Ltd (www.altitudeconservation.com).
Previously worked as a Wildlife Telemetry Consultant at Sirtrack.
PhD research on the population ecology and foraging behaviour of yellow-eyed penguins in New Zealand's subantarctic Auckland Islands.

Accurate and efficient data collection will be required to meet the goals of Predator Free 2050, and for conserving taonga species in the future. Ecological studies often require locating animals and monitoring their movements, including endangered species and invasive pests.

VHF-radio tracking is widely-used for locating and monitoring wildlife, but the equipment has changed little since the 1980s. New multi-frequency receiver technology can revolutionise conservation research, especially when paired with aerial tracking technology.

Tracking from the air offers many advantages over traditional ground-based survey and research techniques. As well as making fieldwork faster, safer, and more efficient, aerial searches can follow an automated flight plan for repeatability. Unmanned Aerial Vehicles (UAVs, or drones) are cheaper and more portable than manned aircraft, making them more accessible to biologists. However, there are a number of technical considerations to get best results from this emerging tool.

We developed a multi-frequency VHF receiver offering many advantages over traditional single-frequency receivers, especially for aerial tracking. Benefits include simultaneous monitoring of 500 frequencies (instead of sequential scanning), and dynamic searching (while moving). Unlike standard receivers, this new technology also stores position data for easy spatial analysis, and comparisons over time.

Here we discuss the evolution of technology and the successes and failures of various methods of using drones, including the performance of different sensors such as thermal imagery and multi-frequency VHF for applied conservation. Using case-studies we present results comparing the efficiency of different tracking methods for locating animals.

Developing a ready-made PAPP bait for landscape stoat control

Murphy E[1], Ghaemaghamy A[2], Hayward T[2], Rickett J[3], MacMorran D[4], Aylett P[3]
[1]Department Of Conservation, [2]Mammalian Corrections Unit, [3]Department of Conservation, [4]Connovation Limited

Biography:
I have over 30 years work experience in the biodiversity area in New Zealand. I have worked on animal pests, toxins and threatened species. My academic background is a mixture of ecology, toxicology and physiology. Recent research is on 1) Developing an aerial PAPP bait for stoats and feral cats, 2) New toxins and delivery systems (Spitfires) for predator control & 3) Novel lures for stoats & rodents.

Stoats were introduced to New Zealand in the 1880s to control rabbits but were quickly implicated in the decline of native birds and are still having a devastating impact. Landscape control of stoats is needed to protect a wide range of threatened species. A ready-made meat bait that could be used as a carrier for vertebrate toxic agents (VTAs) and is suitable for bait stations, hand-laying and aerial delivery has been developed. A hand-laying trial with non-toxic baits spread over c.1000 ha in the Borland Valley, Fiordland, found that stoats ate or removed baits on 55 of 58 encounters. Very few baits were taken by non-target species. We have also been trialling the baits with different formulations of para-aminopropiophenone (PAPP), a relatively humane toxin. We trialled 120 mg PAPP/bait, hoping this would not only kill stoats, but also be lethal to feral cats and ferrets. Two bait-station trials for stoats were undertaken in the Borland Valley. The first trial achieved a > 80% decline in stoat abundance, and the second trial achieved a c. 50% reduction. In captive trials, this encapsulated PAPP bait was not effective on feral cats and because of potential non-target issues with higher doses, we are now investigating a lower dose of encapsulated PAPP in a bait that targets only stoats.

The other 80%: Understanding the consequences of the predator free movement for terrestrial invertebrates

Murray T[1]
[1]*Terrestrial Science Unit, Department of Conservation*

Biography:
Tara's work with terrestrial insects has included biosecurity, climate change, monitoring and threatened species. She has a BSc(hons) (Otago University), and did her PhD with Forest Research, before a postdoc at the Hawkesbury Institute for the Environment, Western Sydney. Tara started a research programme on methods to manage threatened insects while a senior lecturer at Canterbury University. She is currently a Threatened Species Science Advisor | Kaitohu Pūtaiao with DOC, primarily focused on developing methods to manage threatened invertebrates in the South Island's dryland, braided river and alpine habitats. She is also vice president of the New Zealand Entomological Society.

The predator free movement has inspired a groundswell of investment from grass-roots community trapping networks to extensive landscape-scale eradication programmes and numerous technological advancements. There is little doubt that some of our seriously threatened birds are already benefitting from this movement. However, for our smaller, but equally threatened invertebrate taxa, the potential impacts of the movement are more complex. Targeting a subset of introduced predators (possums, rats and stoats) has several consequences that may not necessarily benefit invertebrates; 1) it fails to address the threats posed by several of the most important predators of invertebrates (e.g., hedgehogs), 2) it has the potential to result in the meso-predator release of other introduced pests (e.g., mice), and 3) it will, hopefully, increase populations of native predators that naturally prey on invertebrates (e.g., native birds, reptiles, large insects and spiders). Although we may assume the net benefit of increased predator control will outweigh any costs resulting from the above complexities, little work is being undertaken to test this. Invertebrate outcome monitoring is neither essential nor realistic for every predator control programme, particularly as no standard methods exist. In light of this, we will discuss what kind of targeted approach we might take to help us better understand the benefits and potential negative consequences of the predator free movement for our endemic threatened invertebrates, so we can learn how to tailor predator control to benefit a wider range of native fauna in the future.

The little ‘problems’: Unique challenges and opportunities in threatened invertebrate translocations

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[1]*Terrestrial Science Unit, Department of Conservation,* [2]*Manaaki Whenua – Landcare Research*

Biography:
Tara’s work with terrestrial insects has included biosecurity, climate change, monitoring and threatened species. She has a BSc(hons) (Otago University), and did her PhD with Forest Research, before a postdoc at the Hawkesbury Institute for the Environment, Western Sydney. Tara started a research programme on methods to manage threatened insects while a senior lecturer at Canterbury University. She is currently a Threatened Species Science Advisor | Kaitohu Pūtaiao with DOC, primarily focused on developing methods to manage threatened invertebrates in the South Island’s dryland, braided river and alpine habitats. She is also vice president of the New Zealand Entomological Society.

Invertebrate species represent the vast majority of multicellular organisms on earth and there is increasing international evidence that they are undergoing unprecedented declines. Yet, there is a well-acknowledged global bias against invertebrates with respect to conservation research, management, and the application of specific tools such as wild-to-wild, or even wild-to-captive translocations. The terrestrial invertebrates of Aotearoa are as unique and fascinating as our other world-renowned fauna and flora, with exceptional levels of endemism not just at species level, but also genus and family levels. Invertebrates face many of the same threats (e.g. habitat degradation, introduced predators and weeds, human disturbance, climate change), and therefore potential management solutions, as their larger, more charismatic, and often feathered counterparts. However, they also face some unique conservation challenges. As a result, translocation has only rarely been utilised to manage threatened invertebrates in Aotearoa and has mostly been limited to a few relatively charismatic insect groups. Here we review the state of invertebrate translocations in Aotearoa and explore some of the unique challenges associated with their size, crypsis, life histories, and poor public image. More importantly, we highlight the many opportunities that some of these same characteristics present that could make translocation a key tool for invertebrate conservation of the future in Aotearoa.

What is predator elimination, and what does it look like?

Nichols M[1]
[1]*Zero Invasive Predators,* [2]*Adjunct lecturer-Lincoln University*

Biography:
Maggie is an ecologist at ZIP, where she works on a range of projects, particularly on the Research and Development of new tools and techniques. She finished up her PhD on optimal monitoring methods using camera traps for feral cats in 2017. Currently, she leads ZIP's stoat elimination research and kea risk mitigation work.

New Zealand is a world leader in eradicating invasive species from off-shore islands and behind predator fences. The Predator Free New Zealand by 2050 mission seeks to remove predators from the mainland – which brings a completely new set of challenges. The conservation industry understands the terms control and eradication, but there is a piece missing –elimination.
Disease management, in the field of public health, defines control, elimination, and eradication clearly, where the "elimination of infection is: Reduction to zero of the incidence of infection caused by a specific agent in a defined geographical area as a result of deliberate efforts: continued measures to prevent establishment of transmission are required".
As New Zealand aims to eradicate predators from the mainland, we must first develop and refine the tools to eliminate them over increasingly large mainland sites, managing incursion on boundaries as we scale up. Here, we discuss a case study from elimination work in South Westland and suggest a methodology for defining 'rat free' areas.

The role of science in re-establishing indigenous lizards at Mokomoko Dryland Sanctuary, Central Otago

Norbury G[1]
[1]*Manaaki Whenua Landcare Research*

Biography:
Grant Norbury is a wildlife ecologist with Manaaki Whenua Landcare Research. He specialises in predator-prey ecology with a view to enhancing native biodiversity, especially in dryland ecosystems. Grant co-ordinates research in Manaaki Whenua for the Predator Free 2050 initiative, working alongside national and regional government, Iwi, philanthropic organisations, community groups and landholders. Grant is also the chairperson of a community conservation group, the Central Otago Ecological Trust, which is restoring native lizard communities lost from central Otago.

Science has underpinned the Central Otago Ecological Trust's (COET) mission to re-establish indigenous lizards inside a predator-free sanctuary. Studies at Macraes in eastern Otago showed that grand and Otago skinks (GAOS) recovered in the presence of mice (with larger predators suppressed), suggesting that a fence that leaks mice, rather than a full exclusion fence, would be a more cost-effective fencing option to protect GAOS in Central Otago. However, subsequent research showed that mice are scarce at Macraes outside mast years, whereas in Central Otago, introduced pastures produce abundant seed every year which maintains high mouse abundance. Small lizards responded well to predator suppression at Macraes, but that was not the case in Central Otago, presumably because mouse numbers were so high. Mouse density-impact functions support these observations, showing high numbers of small lizards only where mouse tracking rates are very low (< c.5%). These studies compelled COET to build a full exclusion fence, starting with a pilot translocation of captive-bred Otago skinks to a 0.3-ha full exclusion fence. Mice breached this fence, and a mouse was seen attacking an adult Otago skink. Survival rates plummeted thereafter. COET has since built a 14-ha full exclusion fence, the Mokomoko Dryland Sanctuary, and numbers of translocated GAOS and jewelled geckos, and pre-existing small lizards, have all increased over the past 4 years. This research provides mounting evidence that mice are critical predators for lizards of all sizes. This is concerning, as mice are difficult to suppress and almost impossible to exclude from fenced sanctuaries. Development of tools and strategies to suppress mice on the mainland are desperately required.

Effects of landscape composition and configuration on feral cats in agricultural ecosystems

Nottingham C[1], Buckley H, Case B, Glen A, Stanley M
[1]*The University Of Auckland*

Biography:
Cathy Nottingham is a final year PhD student from the University of Auckland. She is currently studying how feral cats use pastoral landscapes. Her main research interests are focused on mammalian pest management.

Managing invasive species requires specific knowledge of their ecology, including habitat use, home range and diet. In particular, understanding home range and habitat use can help with pest management decision-making, as well as informing native species management. Increased restoration of agroecosystems to improve vegetation connectivity for native biodiversity could have the perverse outcome of enhancing connectivity for pest mammals. Feral cats pose a threat to native species and have caused numerous extinctions globally. Managing feral cat populations requires spatially-explicit knowledge to enable appropriate deployment of management devices, understand where native species are most likely to be at risk, and to mitigate the spread of cat-vectored diseases, such as toxoplasmosis. Our project investigates feral cat movement and diet on sheep and beef farms. We collected GPS data from 14 feral cats across 11 pastoral farms in rural Auckland for up to 13 weeks. Home ranges were highly variable (4 – 900 ha) and individual cats used the habitats differently, with some preferring forest habitat patches while others preferred pasture. Cat movement patterns differed between forest and pasture; cats in forest moved shorter distances per unit time and displayed higher tortuosity compared to pasture, indicative of hunting behaviour. Dietary analysis of feral cats from agroecosystems across New Zealand (n = 112) found regional differences in diet composition, although variability was high. Our results suggest individual variation among feral cats will be critical to consider when undertaking feral cat management programmes in pastoral landscapes.

Quantifying impacts of stoat and cat incursions on reintroduced bird populations in a predator-fenced wildlife sanctuary

Parker K[1], Parlato E[2], Lovegrove T[3], Maitland M[3], Stone Z[2], Armstrong D[2]
[1]Parker Conservation Ltd, [2]Massey University, [3]Auckland Council

Biography:
I am a conservation scientist with expertise in threatened species management, reintroduction biology and restoration ecology. My research and management perspective has been strongly influenced by my extensive experience in applied conservation management through work as a conservation scientist, park ranger, zookeeper, and through direct involvement in 73 translocations. These practical experiences are a fertile ground for theoretical and applied research questions to understand and improve conservation management. My current research interests are the impacts of dispersal on translocation success, particularly in large landscapes, and the development of applied tools to improve threatened species recovery.

Control of introduced mammalian predators is essential for conserving populations of many New Zealand species. However, vulnerability to introduced predators varies. Therefore, a prerequisite for management is estimating the tolerances of a range of native species to introduced predators. Here, we quantify population responses of reintroduced toutouwai (*Petroica longipes*), popokatea (*Mohoua albicilla*) and tīeke (*Philesturnus rufusater*) to increased numbers of stoats (Mustela erminea) and cats (Felis catus) at 588-ha Tāwharanui Open Sanctuary. There were fewer than 0.5 detection per year for these predator species 2004–2016, but stoat detections increased >10-fold 2017–2019 and cat detections >30-fold 2020–2021. We therefore estimated the growth and persistence of each bird population pre- and post-2017. For toutouwai and tīeke, this involved fitting integrated population models to survival, reproduction and count data, and for popokatea it involved fitting a dynamic logistic model to five-minute point counts. We used these models to derive λmax, the finite rate of increase at zero density, which must be > 1 for a population to persist. The popokatea population showed no sign of having been impacted by the increase in stoats of cats, with λmax estimated to be 1.68 (95% CRI 1.49–1.97) up to 2017 and 1.87 (1.42–2.62) after 2017. The toutouwai population showed decreases in survival and reproduction which were tentative but sufficient to drop the estimated λmax from 1.28 (1.10–1.51) to 1.06 (0.83–1.41). Tīeke showed a dramatic reduction in survival from 2017–2019, which together with a decrease in recruitment rate resulted in the population dropping from c. 350 to c. 100. Survival returned to pre-2017 levels when stoats were reduced, but recruitment remained low, presumably due to the cats. λmax was estimated to be 1.74 (1.04–2.70) on pre-2017 rates, 1.14 (0.80–1.71) if only recruitment were predator-affected, and 0.79 (0.36–1.36) if both adult survival and recruitment were predator-affected. These data show that while popokatea are completely tolerant of the stoat and cat levels detected at Tāwharanui pre and post 2017. In contrast, it is unclear whether toutouwai could persist, unclear whether tīeke could persist with the cats, and unlikely tīeke could persist, even with small numbers of stoats.

Structured decision-making to guide values-based conservation of the critically endangered Kuaka/Whenua Hou Diving Petrel

Parker K[2], Fischer J[1], Kenup C[3], Taylor G[1], Debski I[1], Ewen J[4]
[1]Department of Conservation, [2]Parker Conservation, [3]Massey University, [4]Zoological Society of London

Biography:
Presented on behalf of Johannes Fischer. Kevin is a conservation scientist with expertise in threatened species management, reintroduction biology and restoration ecology. My research and management perspective has been strongly influenced by my extensive experience in applied conservation management through work as a conservation scientist, park ranger, zookeeper, and through direct involvement in 73 translocations. These practical experiences are a fertile ground for theoretical and applied research questions to understand and improve conservation management. Current research interests are the impacts of dispersal on translocation success, particularly in large landscapes, and the development of applied tools to improve threatened species recovery.

Hidden values can create conflict. Therefore, transparency through explicit statements of underlying values can improve implementation of conservation management. This is particularly true for seabird conservation because seabirds utilise different ecosystems, increasing the number of values and uncertainty, further complicating management decisions. Through a structured decision-making process, we enabled values-based conservation of Kuaka/Whenua Hou Diving Petrels (*Pelecanoides whenuahouensis*), which persist in low numbers (~210 adults) at a single colony on Whenua Hou/Codfish Island and are at risk from a several threats (e.g., storm-induced erosion, interspecific competition, and vessel-based light pollution). We formed a working group consisting of Kāi Tahu, government, and industry representatives. Together, we identified seven fundamental objectives (values) and eleven management alternatives, ranging from Status Quo to translocations and vessel curfews. By combining expert panels, Shiny-app-based elicitations, and projections using integrated population models (IPMs), we then predicted future outcomes, including associated uncertainty across objectives for all alternatives. This approach allowed the working group to navigate the decision landscape, avoid conflict, make well-informed trade-offs, and identify the best potential management option for Kuaka. A values-based approach allowed for transparent and inclusive decision-making for conservation management of Kuaka and has the potential to improve the recovery of many other threatened seabirds worldwide.

To translocate or not to translocate? Population modelling to support decision-making for the Chatham Islands black robin

Parlato E[1]
[1]*Massey University*

Biography:
Liz has recently finished a Post-doctoral Fellowship at Massey University, and has previously worked in conservation-related positions in Ireland and Canada. Liz is passionate about wildlife reintroductions, and a strong focus of her research has been improving methods for predicting reintroduction outcomes. Her research has also investigated the impacts of inbreeding, behaviour and habitat quality on the viability of translocated populations.

The recovery of the Chatham Islands black robin from the brink of extinction is a world-famous conservation success story in which translocation played an essential role. In 1976 the need to move the 7 remaining black robins to a new location was clear. However, decisions about whether or not to undertake a translocation are rarely so straightforward. This is exemplified by the contemporary decisions being faced by managers about whether translocations can help achieve fundamental objectives for black robins. Key questions linked to these decisions are: Will a reinforcement translocation improve the prospects of the declining Mangere Island population? Can the larger Rangatira Island population withstand removal of individuals for translocation? If black robins are released at a new site is this new population expected to grow? To address these questions, I modelled empirical and expert-elicited data as part of a structured decision-making process. The models predicted that reinforcing the Mangere population with 10 females in 2022 would increase the median estimated female abundance in 2030 from 4 (no reinforcement) to 15, and that removal of 10 females from the Rangatira population would have a negligible impact on Rangatira female abundance in 2030. Predictions for a new site indicated the population would be expected to grow (median $\lambda > 1$), although this was not certain (λ credible interval included 1). This ability to generate quantitative predictions of translocation outcomes for source and release populations proved to be a powerful tool to support decision-making for black robins.

Effect of multiple stressors on the population viability of a threatened endemic waterfowl, pāteke (*Anas chlorotis*)

Lee F[1,3], Bellvé A[1], Alena H[1], Asena Q[1,2], Perry G[1]
[1]*Waipapa Taumata Rau / University Of Auckland,* [2]*The University of Wisconsin,* [3]*Cawthron Institute*

Biography:
I am interested in the dynamics of forest ecosystems at spatial scales from the population to the landscape and at temporal scales from decades to milennia. All of my research involves a strong field-based component supported by simulation and/or statistical modelling, including machine learning.

Since 1500 A.D., extinction rates for birds have been at least 100-times above the background average. The pāteke/brown teal (*Anas chlorotis*) is a threatened waterfowl endemic to New Zealand, with a current population of c. 2500, spread across two remnant populations, reintroduction sites, and captive breeding programs. The historical decline of pāteke since the arrival of humans results from habitat loss and fragmentation, predation, and other anthropogenic interactions. We used population viability analyses (PVA) and species distribution modelling to understand the i better) drivers of the species decline in one of the two remnant populations on Aotea/Great Barrier Island, ii) management interventions most likely to reduce extinction risk and iii) historical distribution of pāteke. We parametrised the PVA using seven years of intensive monitoring data from the population at Okiwi, Aotea. Our PVA forecasts suggest the pāteke population on Aotea has a 38% chance of extinction within 100 years and a 96% chance of pseudo-extinction. Management focused on individual threats is unlikely to increase population resilience, and any management interventions should target the adult and fledgling life stages. Species distribution modelling results suggest that pāteke were present across much of coastal New Zealand, and it was possibly the most abundant and widespread waterfowl species in the country before human arrival. Just as population declines are frequently the result of multiple stressors, multiple interventions are often required to halt extinctions. For pāteke, this means controlling multiple predator species, improving habitat quality, and re-establishing populations across their former range.

Oranga Tangata, Oranga Taiao: Wellbeing of People and Nature

Pihera-ridge K[1]
[1]*Scion Research*

Biography:
Katerina Pihera-Ridge -
Ngāti Rangiwewehi, Ngāti Whakaue, Ngā Puhi, and Czech Republic whakapapa. An active Iwi member, Trustee and Tari Taiao representative, Indigenous Researcher, Social Science, Ethno-ecology and Rongoā Māori practitioner with Treaty Settlement, Policy, Planning and Partnerships experience. Katerina holds the position of Scion Research Portfolio Leader on Restoration, Protection and Mauri o Te Waonui a Tāne; biosecurity, bio-protection research for indigenous forests; and, Te Ao Māori kaitiakitanga, indigenous and mātauranga Māori research pathways.

Te Ao Māori has had it's people and worldviews challenged since He Whakaputanga 1835 and Te Tiriti o Waitangi 1840 were signed. These agreements - to live as two people in one land, acknowledged the sovereignty and lore of tangata whenua and agreed to protect their authority in relation to taonga, including flora and fauna. Soon after, land and natural resources were alienated from the people of the land and exploited.

Tangata whenua have not only an association to the natural world, but a relationship that is grounded on genealogical interconnectedness to Atua Māori. Despite colonisation, the shattered connection of kinship to Te Ao Tūroa has not been lost due to the resilience, resurgence and resistance of tangata whenua and pursuit of Te Tiriti rights. What does this mean for partnerships, conservation and biodiversity in Aotearoa? Active participation and inclusion of tangata whenua in decision-making and research, has resulted in numerous opportunities and environmental benefits. Mātauranga Māori, traditional ecological knowledge and kaitiakitanga approaches are advancing prospects for 'oranga tangata, oranga taiao'.

Restoration, Protection & Mauri o Te Waonui a Tāne is a new research portfolio that manages Scion's biosecurity, bio-protection and abiotic/biotic research for indigenous ngahere. The portfolio has established a Te Ao Māori research pathway that is Māori-led and supported by science. It will enable kaupapa Māori ecological approaches that explore, share and confirm what is seen and unseen within Te Waonui a Tāne – the great forest of Tāne.

The Monitoring Tumu within Coastal People Southern Skies

Pritchard D[1], Currie K
[1]*University Of Otago,* [2]*NIWA*

Biography:
Dr Daniel Pritchard is the co-lead of the Monitoring Tumu with Kim Currie. He has had a key role in an innovative end-user focused monitoring programme for the Ngāi Tahu Customary fishery Protection Area (CPA) network. The programme empowers kaitiakitanga (application of local guardianship) by Tangata Tiaki/Kaitiaki (Customary Fisheries Managers) through fishery regulations and bylaws that support the needs and vision of the community they represent.

Monitoring is fundamental to our understanding of the marine environment today and what will come in the future. To prepare for and predict what will be, we must know what is. To manage and restore, we must observe and record change. In Aotearoa New Zealand, there has been significant underinvestment in high quality long-term marine monitoring, leaving coastal communities underprepared to confront the challenges of climate change. In the framing metaphor of Coastal People Southern Skies (CPSS) as a double-hulled waka, the Monitoring Tumu (mooring post) has a foundational and stabilising role, connecting back to fixed and permanent places. It will span the full 7.5-year term of CPSS, providing platforms and opportunities for monitoring and coordinate, promote, and support high quality data collection within CPSS. One of the key workstreams within the Tumu is to establish fixed-point, subtidal biogeochemical and environmental moorings within important habitats at anchor sites across the latitudinal gradient of Aotearoa New Zealand. The first anchor site is at Karitane on the Otago coast. This project builds on a history of successful data collection, support for aligned research projects and of community engagement and support. As well as implementing local monitoring, this first project will develop methods, approaches and resources that will be utilised within the Tumu and elsewhere within CPSS. Here we will provide an overview of projects within the Monitoring Tumu, including how partnership with coastal communities is central to our approach.

Bryophytes as indicators of exotic plantation forest suitability for native regeneration.

Pritchard A[1], Lord J[1]
[1]*University Of Otago*

Biography:
I am currently in my first year of a Masters Degree at the University of Otago study the ecology of bryophytes and their response to environmental changes and anthropogenic disturbance. I have been studying bryophytes since 2009 and went on to work for the Department of Conservation on the LUCAS program. I have recently returned to NZ after living overseas for 6 years and am now pursuing further study on bryophytes.

Bryophytes are of considerable ecological importance in forest ecosystems. New Zealand has a high level of bryophyte diversity at small spatial scales but deforestation and anthropogenic disturbance has affected their abundance and distribution. Furthermore, there is limited data on the ability of commercial forests to provide habitat for native plants, let alone traditionally overlooked functional groups such as bryophytes.

This talk examines the impact of forest types and management practices on bryophyte abundance and diversity and explores the potential value of bryophytes as indicators of environmental conditions in managed forests. An understanding of how forest management practices affect bryophyte abundance and diversity can provide insight into the regeneration of other native forest species in non-native plantations.

Tools to develop a monitoring programme to measure changes in trends of bat acoustic activity in response to predator control within native forest.

Pryde M[1], Cockburn S[1], Gansell O[1]
[1]*Department Of Conservation*

Biography:
I am a technical advisor at the Department of Conservation in the Terrestrial Species and Ecosystems Group. I mainly work on bats looking at the responses to predator management in native forests.

Acoustic recorders were developed by the Electronics Department, Department of Conservation in 2014. They were designed to be relatively light, use componentry that is easily available and relatively cheap so that a large number could be produced. New Zealand has two main bat species so the electronics to produce bat recording equipment is simpler than those needed overseas. Monitoring equipment to measure bat activity in other countries at that time was large and expensive.
Home ranges of long-tailed bats tend to be large (100km^2). Predator control for bats therefore needs to cover large areas. Developing a monitoring system for bats is difficult. Resource intensive methods involve marking bats, finding roosts and measuring survival. These methods are expensive and there is a limit to how many sites can be completed. We wanted to trial an index method to test the efficiency of our pest control.
We did a power analysis using the package SIMR developed to test the number of acoustic recorders, number of days to leave the recorders out and the number of years to detect a 5% annual change with 80% power. The placement of the acoustic recorders was calculated using balanced acceptance sampling to produce a master sample set of points.

Big numbers of small wētā: Nationally Critical Tekapō ground wētā (*Hemiandrus 'furoviarius'*) benefit from predator-exclusion fence

Pye M[1], Murray T
[1]*University Of Otago*

Biography:
Maddy is passionate about the conservation of native wildlife (especially insects). She graduated with a BSc in ecology from Massey University and recently completed a Master of Wildlife Management with the University of Otago on the conservation and ecology of the nationally critical Tekapō ground wētā.

New Zealand is a world leader in mammalian predator fencing for the protection of native flora and fauna. However, there is little known about how invertebrates respond to predator fencing, especially outside of forested environments. I examined the impact of a small predator-exclusion fence on the Nationally Critical Tekapō ground wētā (*Hemiandrus 'furoviarius'*) in a dryland environment (degraded grassland, Mackenzie Basin). Wētā were captured over 17 days from November 2021 to January 2022, using 467 baited pitfall traps, half inside the fence and half outside at a control site. A total of 1,403 wētā were captured, with 4.8 times as many caught inside the fence compared to the control site. Wētā were present more often in pitfalls surrounded by sparce, low growing vegetation, compared to short or long grasses. Additionally, female wētā at the control site were smaller than those caught inside the fence. We hypothesise that the predator-exclusion fence had a significant impact on the abundance of Tekapō ground wētā because of the exclusion of hedgehogs (Erinaceus europaeus), an abundant predator in the Mackenzie Basin. Our results suggest the Tekapō ground wētā is not as rare as previously thought and the strong apparent response of the Tekapō ground wētā to predator exclusion may make it a good indicator of predation pressures on invertebrate communities across Mackenzie Basin dryland environments.

Temporal subsampling of passive acoustic data for improved detection of Australasian bittern, a crepuscular and cryptic bird

Rafi F[1], Thompson M[2], Monks J[1]
[1]*Department of Zoology, University of Otago,* [2]*Birds New Zealand*

Biography:
Zohara is the organizer of this symposium and a PhD student at the University of Otago. She started her bioacoustics career building customized bioacoustic recorders to monitor the biodiversity of an offshore island in Singapore.
For her PhD, she is exploring how active and passive bioacoustic monitoring can aid conservation of native birds in NZ.
Her talk is based on a collaboration among Birds NZ, the Otago Regional Council, and the Department of Conservation on a long-term wetland bird monitoring project.

When building automatic detectors for monitoring purposes, the standard practice is to create one optimal detector with high precision and high recall. This is a challenge due to variable background noise in the soundscape altering the signal-to-noise ratio (SNR). Here we explore how subsampling of recordings can improve signal recognition. For passive acoustic monitoring, duty cycles (recording periods) are often decided based on the species' acoustic activity patterns. For crepuscular birds, like Australasian bitter
ns (*Botaurus poiciliptilus*; matuku), the duty cycles are usually one or two hours before and after dawn and dusk, thus making it an ideal model to test how subsampling can improve signal recognition.
As part of a long-term bittern monitoring project at Sinclair Wetlands, Otago, using the DOC ARD VerB.2, we made 15-minute recordings at a sampling rate of 8kHz from 0400-0700hr and 2100-0000hr from 15 October to 19 November 2016. We manually labelled all boom calls in Raven Pro 1.6, built an energy-based automatic detector with an SNR threshold of 10dB, and calculated recall and precision. Values for minimum and maximum frequencies, minimum and maximum durations, and minimum separation were taken from a sample from the night with the highest number of booms. We then sub-sampled the data into two groups, dawn and dusk, and used the exact measurements from the first automatic detector but different SNR values to recalculate recall and precision. We demonstrate that both recall and precision can be improved when large acoustic data are subsampled for conservation monitoring.

Enough kai for kākāpō? Estimating the abundance of mature rimu in Puketahā

Rammell S[1], Uys R[2], Hartley S[1]
[1]*Centre for Biodiversity and Restoration Ecology, School of Biological Sciences, Te Herenga Waka,* [2]*Greater Wellington Regional Council*

Biography:
Sam Rammell is a Masters student in the Centre for Biodiversity and Restoration Ecology at Victoria University. His research focus is on techniques to analyse low-quality Citizen Science data and mapping species' distribution and abundance. Of particular interest is the analysis of presence-only data commonly found in Citizen Science projects. His thesis will focus on the analysis of the data collected through The Great Kereru Count over the last 8 years, a project which has gathered a significant amount of presence-only data.

Kākāpō management over the last several decades has involved translocations to predator-free islands safe from invasive mammalian predators. However, the success of modern ring-fenced predator-free sanctuaries provides hope for the possibility of returning kākāpō to the mainland. Puketahā, the proposed eco-sanctuary in Wainuiomata, is thought to contain high quality habitat capable of supporting over 100 kākāpō. Rimu fruit is an important food source for kākāpō in breeding years and understanding rimu abundance is key to estimating the viability of breeding populations. LiDAR data collected across the sanctuary area were used to create a virtual model of the forest, delineating all large tree crowns and calculating metrics related to tree size, shape, and spectral characteristics. 388 trees were sampled from which a Support Vector Machine was constructed capable of distinguishing rimu from 5 other tree species with a user's accuracy of 69.2%, producer's accuracy of 64.8% and specificity of 86.3%. We estimate a total abundance of 13,211 mature rimu at a density of 3.94 individuals per hectare with a mean crown size of 183 m2. Further, we estimate that total seed production per hectare is similar to that of Codfish Island which currently sustains the largest breeding kākāpō population in New Zealand. In addition, Puketahā contains an abundance of supplementary food sources, including 704 mature kahikatea, 2,753 miro, and 6,573 rata. Based upon these results we suggest that Puketahā could sustain a population of up to 200 kākāpō with the capability of breeding success equal to that of Codfish Island.

Should I stay or should I go? Pair bond status is influenced by male nesting effort in North Island Brown Kiwi

Ramos Pallares E[1], Gibb G[1], Castro I[1]
[1]*School of Natural Sciences, Massey University*

Biography:
I am PhD student at Massey University, my research interests center on natural history, ecology and gaining a better understanding of the way species respond to change. I like the application of different approaches including ecology, morphology, taxonomy, and spatial-temporal analyses to explore ecological responses and conservation.

Animal interactions are essential for social integration and cooperation, often resulting in shared benefits such as reduced predation and increased resource acquisition, but also influencing fitness outcomes. Social interactions between males and females have been linked, for instance, to reproductive components such as fecundity, breeding success, and offspring survival. Therefore, establishing and maintaining social interactions between reproductive pairs may represent a critical step toward successful reproduction. We used a Bayesian statistical modelling approach to describe patterns of divorce and partner fidelity in a population of North Island Brown Kiwi (*Apteryx mantelli*) on Ponui Island. We investigated the influence of breeding status, familiarity, and male quality characteristics on pair bond maintenance. We also examined whether mate familiarity boosted breeding success by enhancing nesting effort and bringing nesting date earlier. We found that kiwi had a low divorce rate, with fidelity consistently associated with higher nesting effort. Male quality and pair familiarity did not have a significant effect on pair bond maintenance. However, familiarity within breeding partners increased the probability of having a full incubation bout, as expected for long-term monogamous birds. Overall, these results suggest some fitness advantages that favour long-term partnership in these birds. The next step is to explore the predictive effects of demographic trends and environmental factors (e.g., droughts) as explanation for our findings regarding interannual and inter-couple variability in incubation effort and full incubation bout success.

The species-specific trophic discrimination factors from experiments and universal values change the trophic position of fish

Scoarize M[1,2,4], Manetta G[1], Delanira-Santos D[1], Urbano V[5], Benedito E[1,3,5]

[1]Graduate Program in Ecology of Inland Water Ecosystems - State University of Maringá, [2]Australian Rivers Institute - Griffith University, [3]Research Nucleus in Limnology, Ichthyology and Aquaculture - NUPELIA, [4]Instituto BiodiverCidade, [5]Department of Biology - State University of Maringá

Biography:

Bachelor of Science in Biology, Master in Environmental Sciences and PhD student of the Graduate Program in Ecology of Inland Water Ecosystems of the State University of Maringá (UEM). International exchange student of the Science Without Borders (SwB) program at the University of Stirling (UK). Researcher of the University Without Borders (UwB) program and the Laboratory of Ecological Energetics. Member of the Tropical Water Research Alliance (TWRA).

The trophic discrimination factor (TDF) is a key parameter for stable isotope analysis and due to a lack of species-specific TDF, mean universal values have been used, resulting in a call for more experiments. In this study we have conducted three experiments of 128 days each to determine the TDF (muscle and liver) of three species (one piscivore and two omnivores) of tropical fishes from La Plata river basin. Then, we calculated the trophic position (TP) for one species that occur in this basin using the mean universal TDF from literature and the species-specific TDF. Finally, we compared the TDF values for other species of the same guilds with other recent experiments. We estimated the TDF for the three species and they differed from the mean universal TDF in the literature. Moreover, the TP was lower when using the species-specific TDF. On average, recent experiments lasted 126 days, but experiments with tropical species presented a lower duration (103 days) than with temperate species (136 days). We recommend using species-specific TDF values for calculating TP once it differed from the results calculated with mean universal TDF. Therefore, these experiments contributed to the aquatic ecology field because there are only a derisory number of them given fish biodiversity worldwide.

Beta diversity of aquatic fungi in subtropical urban and rural streams

Scoarize M[1,2,4], Rasvailer V[1], Pinha G[1], Contieri B[1], Benedito E[1,3]
[1]Graduate Program in Ecology of Inland Water Ecosystems - State University of Maringá, [2]Australian Rivers Institute - Griffith University, [3]Research Nucleus in Limnology, Ichthyology and Aquaculture - NUPELIA, [4]Instituto BiodiverCidade

Biography:
Bachelor of Science in Biology, Master in Environmental Sciences and PhD student of the Graduate Program in Ecology of Inland Water Ecosystems of the State University of Maringá (UEM). International exchange student of the Science Without Borders (SwB) program at the University of Stirling (UK). Researcher of the University Without Borders (UwB) program and the Laboratory of Ecological Energetics. Member of the Tropical Water Research Alliance (TWRA).

The energetic dynamics of streams (small rivers) are diverse and depend on allochthonous organic matter through decomposition. This is mainly performed by aquatic fungi, which are affected by abiotic variables, thus they have been the focus of ecological studies. However, there is a lack of studies on β-diversity and fungi, as well as for any fungal diversity study in the Neotropics. Anthropogenic impacts on urban and rural streams can result in changes in fungal composition and consequently affect ecosystem functions. In this context, we analysed the beta diversity of aquatic fungi associated with plant debris in: 1) ten urban and rural streams and 2) three sub-basins of the La Plata river basin. These data was compared to limnological variables and to substrate heterogeneity. While the substrate heterogeneity did not differ between urban and rural streams, the heterogeneity of limnological variables did and was higher in rural environments. Intriguingly, β-diversity was higher in urban streams, but did not differ among the evaluated sub-basins. Nevertheless, there were more sensitive species in rural than in urban streams. Hence, the urban community may be influenced by extra organic matter from the cities favouring tolerant species while a higher heterogeneity (variability) of limnological data favoured sensitive species. Thus, anthropogenic disturbances may lead to a loss of species sensitive to variations in the ecosystem. Although the urban streams presented higher diversity, they had a lower number of rare species; however, the microfungal ecological relationships are still elusive. Therefore, we suggest that new experiments test these relationships.

The contribution of kurī (Polynesian dog) to the ecological impacts of the human settlement of Aotearoa New Zealand

Greig K[1], Rawlence N[2]
[1]Southern Pacific Archaeological Research, Archaeology Programme, University of Otago, [2]Otago Palaeogenetics Laboratory, Department of Zoology, University of Otago

Biography:
Nic Rawlence is the Director of the Otago Palaeogenetics Laboratory. His lab focuses on using ancient DNA and palaeoecological techniques to reconstruct prehistoric ecosystems, the impacts of climate change and humans on these ecosystems, and how we can learn from this to conserve taonga species and conduct ecological restoration.

The pre-human Aotearoa New Zealand fauna was dominated by avian and reptilian species. Prior to first human settlement by East Polynesian colonists, the top predators were two giant raptorial birds. Aside from humans themselves, colonisation also resulted in the simultaneous introduction of two novel mammalian predators into this naïve ecosystem, the kiore (Pacific rat) and kurī (Polynesian dog). While the ecological impacts of kiore are relatively well understood, those of kurī are difficult to assess, and as such kurī have frequently been disregarded as having any meaningful impact on New Zealand's biodiversity. Here we use the archaeological and palaeoecological record to reassess the potential impacts of kurī on this ecosystem. We argue that far from being confined to villages, kurī could have had a significant widespread but relatively localised impact on New Zealand's avian, reptilian and marine mammal (seals and sea lions) fauna as a novel predator of medium-sized species. In this way, kurī potentially amplified the already significant impacts of Polynesian colonists and their descendants on New Zealand's ecosystem, prior to European arrival. As such, kurī should be included in models of human impact in addition to over-hunting, environmental modification and predation by kiore.

Parāoa of the South Pacific: new perspectives on connectivity among sperm whale populations

Rayment W[1,2], Alexander A[1,2], Simpson S[1,2], Steidl W[1,2], Guerra M[1,2]
[1]University Of Otago, [2]Coastal People: Southern Skies Centre of Research Excellence

Biography:
Will is a Senior Lecturer in the Marine Science Department at University of Otago, and leads the Marine Megafauna Research Group. He is a co-leader of the Connecting Theme in the Coastal People: Southern Skies Centre of Research Excellence.

Mirroring the journeys of Māori and their Polynesian whanaunga, parāoa (sperm whales; Physeter macrocephalus) range widely across Te Moana nui a Kiwa, but we have limited understanding of how the different parts of their distribution are connected, and therefore how impacts in one area are manifested in others. For example, the number of parāoa visiting the Kaikōura submarine canyon is declining, threatening important connections with coastal communities, including a thriving whale watching industry reliant on mātauranga Māori, resources and people. We highlight the relationships between Kaikōura parāoa and te taiao (the environment) by investigating how sperm whale numbers at Kaikōura are related to changing ocean conditions, and how they are connected with other parts of their range. For the first time, we are conducting systematic surveys off the coasts of Otago and Northland to characterise parāoa using these areas, and contrast their behaviours. We will look for individual movements among sampling locations using photo-identification and comparisons of acoustic dialects, as well as gene-flow, using state of the art sequencing and genotyping techniques on non-invasively gathered skin samples. The current management information for New Zealand parāoa is largely limited to investigations framed by western science, and mainly focussed on a single region. Therefore, an essential part of this project will be understanding historical and contemporary distribution and movements of sperm whale populations in a co-led process with hapū and tohunga parāoa, by interweaving mātauranga and Pacific traditional ecological knowledge with insights from our study.

Can flammability be predicted from sister taxa?

Reading S[1], Alam A[1], Paterson A[1], Sullivan J[1], Curran T[1]
[1]*Lincoln University*

Biography:
Samantha is in her final year of a Bachelor of Science majoring in Conservation and Ecology at Lincoln University. Previously, she has trained as a ranger for the Department of Conservation. During her studies, Samantha has taken an interest in plant flammability, working alongside Dr Tim Curran to further this research.

Fire has been an integral part of the evolution of terrestrial plants. The warming climate has led to more frequent and intense wildfires, making the study of plant flammability crucial. Previous research has shown that flammability is phylogenetically conserved. To further investigate these findings, we asked the question: to what extent can flammability be predicted from sister taxa? To do this, we compared the shoot flammability within 11 pairs of sister taxa found in New Zealand. Seven out of the 11 species pairs tested had no significant difference between sister taxa for any of the four flammability variables (ignition time (IT), maximum temperature reached (MT), % burnt biomass (BB), burn time (BT)). Two pairs (Plagianthus and Populus) each differed between sister taxa for one flammability variable (IT and MT, respectively), while the Pittosporum pair had differences in both IT and BB. The Melicytus pair (*M. alpinus/M. crassifolius*), differed for all flammability variables tested. Our results suggest that while flammability is mostly phylogenetically conserved, and a useful assumption, it cannot be accurately inferred from sister taxa across all genera. We suggest that phylogeny cannot be used in isolation to make recommendations for low flammability plantings because the stakes are too high, as inaccurate recommendations could result in a loss of property or even loss of life. Information on both phylogeny and traits could be used to make predictions and then flammability tests conducted to assess the effectiveness of such estimates in situations where accuracy is critical.

When cats rats, and mustelids are away, the mice will play: The risks and challenges of mesopredator release of mice in Aotearoa New Zealand ecosystems

Reardon J[1]
[1]*Department Of Conservation*

Biography:
James is a herpetologist and invasive predator specialist working at the Department of Conservation. As well as species recovery management planning for threatened lizards James is involved in a number of herpetological eradications in New Zealand and overseas and is a member of the Island Eradication Advisory Group

The launch of Predator Free New Zealand has seen a dramatic increase in the funding of predator trapping with the stated aim of eradicating all rat and mustelid species and brush tailed possum from Aotearoa. Whilst there would be biodiversity benefits from such an outcome, the incomplete list of pest species being targeted raises concerns about mesopredator release. It is likely that in the absence or low densities of rats and mustelids, that other introduced predators will experience ecological release. Subsequently, mesopredators may represent a greater threat to some fauna than did the predators targeted for eradication. Mice are a good example. On Subantarctic Islands mice are observed to prey upon nesting seabirds more than 300x their mass. In Aotearoa mice have been observed preying on lizards more than twice their mass. Whilst we have effective tools for the eradication of mice on offshore islands, these tools aren't scalable or transferable to mainland Aotearoa, considering agroeconomic, logistical and social challenges. Mouse control tools are constrained in effectiveness and testing them suggest there are serious limitations to their use. Our understanding is further hampered by our ignorance of mouse predation patterns of vulnerable prey such as endemic lizards, where 97% are Threatened or At Risk (n=126). These considerations justify the need for improved mouse ecology research including their impact relationships with vulnerable fauna, and the need for improved control and eradication tools. It also emphasises the need for conservation strategies to be underpinned by sound ecological principles with clear biodiversity objectives.

Falafolalaoa – spreading the mats of welcome and belonging for Pacific families

Richards R[1,2], Ruhe T[2], Mapusua T[2], Lameta M[2], Hepburn C[1], Taripo M[1], Leurquin L[2]
[1]*Coastal Peoples Southern Skies Core, University Of Otago,* [2]*Va'a o Tautai - Centre for Pacific Health, University of Otago*

Biography:
Associate Professor Rosalina Richards is Deputy Director of the Va'a o Tautai – Centre for Pacific Health and Co-Deputy Director of the Coastal Peoples Southern Skies Centre for Research Excellence at the University of Otago. From Samoan and English ancestry she was born and raised in Te Wai Pounamu, the South Island of Aotearoa. Her academic background is in Psychology, Public health and Pacific health.

Pacific models of health emphasise the importance of the natural environment for well-being, with indigenous Pacific communities intrinsically linked with their environmental context. While, as Pacific peoples living in Aotearoa, we no longer have access to many aspects of these original environments, (re)connecting with the sea and coastal environments in Aotearoa has the potential to play a role in strengthening cultural identity, belonging and well-being among Pacific peoples. The aim of this project is to hold a series of three Talanoa with members of our Ōtepoti Pacific community with four key lines of inquiry; a) connections between coastal environments and notions of well-being b) traditional Pacific concepts analogous to kaitiakitanga c) how the findings of a & b could be adapted or enacted from the context of living in Ōtepoti and d) what are the opportunities for this or further research to add value to existing community programmes. As this project is in its beginning stages this talk will focus on the Fa'afaletui, Data Voyaging and Kakala models that have underpinned the development of the project. Each of these models uses imagery from the physical environment to describe some Pacific approaches to the research process.

Global variation in the contributions of urban nature to people

Richards D[1], Belcher R[2], Stanley M[3]
[1]Manaaki Whenua, [2]Science and Solutions for a Changing Planet DTP and MRC Centre for Environment and Health, School of Public Health, Imperial College London, [3]Te Kura Mātauranga Koiora – School of Biological Sciences, University of Auckland

Biography:
Dan Richards is a researcher at Manaaki Whenua – Landcare Research, New Zealand. His work looks at how ecosystems provide benefits to people, including in cities. Through better understanding the benefits of urban nature, he hopes to inform urban planning to design cities that are safer, more livable, and resilient to future climate change. He has worked previously in Europe and Southeast Asia, and has published over 50 peer-reviewed papers.

Urbanisation has created severe environmental challenges, including elevated temperatures, increased flood risk, and reduced opportunities for residents to experience nature. Urban vegetation can mitigate urban challenges through providing important contributions to people; for example by cooling the air, retaining storm water, and providing recreational spaces for residents. There is increasing interest among planners and designers in better incorporating nature into cities, but we lack an understanding of which contributions of urban nature have the greatest potential, and how this varies across the climatic and economic diversity of cities in different parts of the world. This talk will present new research that aims to give us a more global perspective on the role that nature can play in future cities. We quantified seven contributions provided by urban vegetation for all cities with more than 250,000 residents, totalling 2,148 cities around the world. Urban vegetation provides substantial contributions to outdoor recreation and stormwater regulation, but is less effective in reducing air pollution in most cities (regardless of the climatic and socio-economic conditions). The contributions of urban vegetation to carbon sequestration, coastal protection, shade provision, and land surface temperature reduction were generally small and varied substantially depending on city climate and human development index. Comprehensive assessments of urban vegetation are essential to maximize efficacy for urban sustainability improvements and support human well-being. New technologies increasingly allow us to quantify the contributions of urban vegetation at high resolution in cities around the world to inform planning.

Marine Microclimates – Can local-scale oceanographic processes provide refuge against climate stressors?

Russell P[1], Smith R[1]
[1]*University Of Otago*

Biography:
My research interests are in physical processes that support marine ecosystems. I integrate a number of research areas, including: Coastal and estuarine processes, Tropical cyclone generated primary production. Putahitanga – Intersection of Mātauranga and oceanography, Sea ice physics.

Coastal communities are facing significant changes in their surrounding ecosystems, including ocean warming and widespread extreme temperature events. These can be viewed as problems that act at a scale beyond that at which coastal communities can respond. However, there is emerging evidence that these large-scale climate change stressors may be buffered by local-scale oceanographic processes (e.g. areas of enhanced mixing and/or seawater velocity regimes). Recent studies have demonstrated that environmental variability at scales of kilometres can produce variable biological responses and spatial refuges ("marine microclimates") from both globally and locally-driven stressors, as well as areas with resistant or more vulnerable subpopulations of ecologically, commercially and culturally important marine species. This project will provide a framework for understanding how large-scale forcing translates into patterns of locally-varying temperature and thermal stress across the inner continental shelf. It will support communities and scientists in identifying and predicting the locations and processes that lead to local oceanographic resilience, as well as vulnerability, in a warming ocean. Through development of a participatory, local ocean temperature observing network developed in southeast New Zealand, in conjunction with simple but accurate heat budget models, we will investigate how interactions between broad- and local-scale ocean physics controls temperature extremes in high value shallow-water marine ecosystems (e.g. rocky reefs, kelp forests, coastal embayments). The results will allow predictions to be made about the locations of habitat-based refugia from climate change, as well as areas of increased vulnerability. These results will create informed and engaged local communities that have strategies to prepare and adapt to climate change across New Zealand and the Pacific.

The global contribution of invasive vertebrate eradication as a key island restoration tool

Spatz D[1], Holmes N[2], Will D[3], Hein S[3], Carter Z[4], Fewster R[4], Keitt B[5], Genovesi P[6], Samaniego A[7], Croll D[8], Tershy B, **Russell J[4]**

[1]Pacific Rim Conservation, [2]The Nature Conservancy, [3]Island Conservation, [4]University of Auckland, [5]American Bird Conservancy, [6]Institute for Environmental Protection and Research, [7]Manaaki Whenua—Landcare Research, [8]UC Santa Cruz

Biography:

James Russell is a Professor of Conservation Biology at the University of Auckland.

Islands are global hotspots for biodiversity and extinction, representing ~ 5% of Earth's land area alongside 40% of globally threatened vertebrates and 61% of global extinctions since the 1500s. Invasive species are the primary driver of native biodiversity loss on islands, though eradication of invasive species from islands has been effective at halting or reversing these trends. A global compendium of this conservation tool is essential for scaling best-practices and enabling innovations to maximize biodiversity outcomes. Here, we synthesize over 100 years of invasive vertebrate eradications from islands, comprising 1550 eradication attempts on 998 islands, with an 88% success rate. We show a significant growth in eradication activity since the 1980s, primarily driven by rodent eradications. The annual number of eradications on islands peaked in the mid-2000s, but the annual area treated continues to rise dramatically. This trend reflects increases in removal efficacy and project complexity, generating increased conservation gains. Our synthesis demonstrates the collective contribution of national interventions towards global biodiversity outcomes. Further investment in invasive vertebrate eradications from islands will expand biodiversity conservation while strengthening biodiversity resilience to climate change and creating co-benefits for human societies.

Research into mouse ecology and eradication from Auckland Island

Sagar R[1], Russell J[2], Broome K[3], Cox F[1], Livingstone J[4], Oyston E[5], Griffiths R[6], Murphy E[7], Horn S[1]
[1]Department Of Conservation, [2]University of Auckland, [3]Department of Conservation, [4]Department of Conservation, [5]Department of Conservation, [6]Island Conservation, [7]Department of Conservation

Biography:
Stephen Horn is the Manager of DOC's recently formed National Eradication Team. Stephen led investigations into the feasibility of the Pest-Free Auckland Island project between 2017 and 2021. Prior to that he was the project manager for the "Million Dollar Mouse" project that eradicated mice from Antipodes Island. He spent two years on Macquarie Island as a dog handler and Team lead as part of their rabbit and rodent eradication. Searching for warmer climates, he now lives in Invercargill

Mice are present on subantarctic Auckland Island (45 889 ha) and many other Southern Ocean islands, where they have negative impacts on native biodiversity, from plants and invertebrates to large seabird species. Eradicating mammalian pests such as mice from islands is an increasingly common and effective conservation response. Eradicating mice from Auckland Island would, in a single operation, see a 350% increase in the size of island cleared of mice; a huge jump in the scale and complexity of operations. The logistical challenges of transporting and applying large volumes of bait required at the scale of Auckland Island requires deviation from current best practice. A lower bait application (two applications of 4 kg/ha cereal baits containing brodifacoum) and summer timing has been proposed, c.f. best practice of two applications of 8 kg/ha of cereal baits during winter. Here, we summarise the research that contributed to the feasibility assessment of eradicating mice from Auckland Island using this adapted method, including low sow rate eradication trials on smaller temperate islands, non-toxic bait uptake trials at site, population trend monitoring during and following a tussock mast event on Auckland Island (a source of uncertainty for eradication success), logistical considerations specific to mouse baiting at Auckland Island, and tool development to reduce operational risk. These trials showed that the eradication of mice from Auckland Island is feasible and worthwhile. This research highlights the value of field trials and feasibility assessments for eradication planning.

The ecology of and pathway to eradication of feral cats from Auckland Island

Jacques P, Sagar R[1], Glen A, Brav-Cubitt T, Recio M, Cox F
[1]Department of Conservation Te Papa Atawhai, [2]Island Conservation, [3]Manaaki Whenua – Landcare Research, [4]Rey Juan Carlos University

Biography:
Rachael is part of the National Eradication Team and was a member of the Maukahuka Pest Free Auckland Island team. Over the last decade the common thread of her research has been island systems; improving the conservation management of species on them and exploring new ways to protect them.

Feral cats are a major threat to global diversity, especially on islands. On Auckland Island (45 889 ha), cats have contributed to severe ecological damage over the past 200 years. Eradication of cats is the only viable long-term solution for restoration of the ecological integrity of the island. However, there are limited precedents for eradication of cats at this scale. This research has focussed on resolving knowledge gaps critical to our assessment of the feasibility of eradicating cats from Auckland Island island. GPS collars were fitted to 29 cats on Auckland Island to understand aspects of their ecology, including home range, habitat selection, daily and seasonal movement patterns. The ability to detect cats in the complex habitats and terrain of Auckland Island is crucial to eradication success; various detection tools have been trialled, including grids of trail cameras across large areas, food dumps, a thermal imaging camera, detection dogs and scat searches. Use of detection tools in combination has led to much greater capture efficiencies with leghold traps. A palatable toxic bait that will significantly reduce the cat population is highly desirable as it will likely reduce the duration, expense and risk of an eradication attempt. Following non-toxic palatability trials, a new readymade feral cat bait was successfully trialled on Auckland Island in summer 2022. The combined results of this research have led to the conclusion that, despite the challenges of terrain and scale, eradication of cats from Auckland Island is feasible.

Learning from failure to improve rodent eradication planning: the case of Gough Island

Samaniego A[1]
[1]*Manaaki Whenua - Landcare Research*

Biography:
Araceli is a conservation biologist with 20 years of experience, always combining biodiversity conservation projects and applied research. She has led and contributed to numerous conservation projects on islands, mainly rodent eradications, all around the globe. She is involved in the development of technological innovations to maximise conservation effectiveness. Her publications always aim to be useful to conservation practitioners.

House mice (*Mus musculus*) are the most widespread invasive rodents. On remote Gough Island (6,500 ha) in the middle of the South Atlantic, mice preying on at least 19 bird species triggered a mouse eradication attempt. After years of trials and planning, aerial baiting took place across the island between June–August 2021, supplemented with a hand-baiting operation around the meteorological station (also headquarters for the eradication). Mouse trapping success was high (57%) the day before baiting began (12 June), and zero the following week and until baiting termination (12 August). We also used trail cameras to assess mouse activity before and after baiting, and found a dramatic population collapse within 3 days and almost zero activity after 7 days. How mice react to bait during eradications is not well understood. In fact, this is the first study with wild house mice during an actual eradication. Our last mouse record (a video), 27 days after the first bait application, may be related to rapid bait disappearance. We expected negligible non-target bait consumption, so the observed high rate of bait consumption by invasive slugs was concerning. We confirmed that at least two species of slugs are present, and that slugs can consume large quantities of rodent bait. This triggered changes in the baiting strategy. We were optimist by the time we left Gough Island. However, mice reappeared 6 months later. A formal review of the project is ongoing; an update of the learnings will be presented.

Which nettle is best? Preference and performance of Kahukura on native and introduced nettle in New Zealand.

Sanger G[1], Jandt J, Lord J
[1]*Otago University*

Biography:
Ko Taranaki tōku maunga
Ko Stoney Creek tōku awa
Ko Ngāi Tamanuhiri tōku iwi
Nō Matakohe ahau
Kei Opohoe tōku kāinga ināianei
Ko Sanger tōku whānau
Ko Greer tōku ingoa
Nō reira, tēnā koutou, tēnā koutou, tēnā tātou katoa
I am scared of most insects, and yet I willingly joined the buggiest of all lab groups, the Jandt lab. I am currently in the last year of my masters degree studying one of our endemic butterfly's, the Kahukura. Its still a bug, but less scary than most, its more their host plants that you need to watch out for.

The 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.

Does white and blue wavelength filtered light influence the activity of rural longtailed bats

Schamhart T[1], Tempero G[1], Browne C[1], Borkin K[2], Ling N[1], Pattemore D[3,4]
[1]Te Aka Mātuatua School of Science, The University Of Waikato, [2]Terrestrial Science Unit, Department of Conservation, [3]The NZ Institute for Plant and Food Research, [4]School of Biological Sciences, University of Auckland

Biography:
My name is Titia Schamhart, I have a background in endangered species conservation and welfare in the Netherlands and Spain. I'm currently completing a PhD in Biological Sciences at the University of Waikato. My research topic is "The effect of artificial light at night on New Zealand long-tailed bats". I have undertaken several lighting impact studies on long-tailed bats in the central North Island of New Zealand, including a peri-urban population in Hamilton City and rural populations in Waitomo district and Pureora Forest. I am currently analysing these data with the intention of publishing the result in the coming months.

International advice for managing effects of artificial light on bats recommends reducing the amount of blue wavelength light to mitigate effects. Until now, we have had to rely on international guidance to develop best practice around which lights are likely to have less impact on long-tailed bats because there has been little research conducted on the relative effects of lights of different colour temperatures with different amounts of blue wavelength for New Zealand's threatened long-tailed bat (*Chalinolobus tuberculatus*). As a first step to understanding effects of blue wavelength light on long-tailed bats, we investigated relative effects of white light (4000K, more blue wavelength light) and amber light (2700K with a blue cut filter, less blue wavelength light) on a rural long-tailed bat population with minimal exposure to ALAN and compared long-tailed bat activity rates to those at control sites over eight weeks. Although bat activity was generally low, bat passes per night were significantly lower (MLR: $p < 0.05$) when lit with white light (mean 4.8 passes/night) compared to the unlit control sites (mean 18.1 pass/night). Activity in the presence of amber light site was lower (mean 10.9 passes/night), but not significantly different to the control sites (MLR: $p > 0.05$). These results indicate that ALAN has a negative effect on long-tailed bat activity, but impacts may be partially mitigated using light sources with less blue wavelength light. This is in line with international guidance.

Artificial light at night: does it affect long-tailed bat activity?

Schamhart T[1], Tempero G[1], Browne C[1], Borkin K[2], Ling N[1], Pattemore D[3,4]
[1]Te Aka Mātuatua School of Science, The University Of Waikato, [2]Terrestrial Science Unit, Department of Conservation, [3]The NZ Institute for Plant and Food Research, [4]School of Biological Sciences, University of Auckland

Biography:
My name is Titia Schamhart, I have a background in endangered species conservation and welfare in the Netherlands and Spain. I'm currently completing a PhD in Biological Sciences at the University of Waikato. My research topic is "The effect of artificial light at night on New Zealand long-tailed bats". I have undertaken several lighting impact studies on long-tailed bats in the central North Island of New Zealand, including a peri-urban population in Hamilton City and rural populations in Waitomo district and Pureora Forest. I am currently analysing these data with the intention of publishing the result in the coming months.

Increasing urban expansion and habitat loss are recognised as key threats to many bat species, including the New Zealand long-tailed bat, pekapeka-tou-roa (*Chalinolobus tuberculatus*). Small, remnant populations of long-tailed bats are present in the Waikato region of New Zealand, including Hamilton City. However, there are concerns that increasing urbanisation and associated increases in artificial light at night (ALAN) may negatively impact long-tailed bat behaviour with effects on habitat suitability and connectivity. To determine whether long-tailed bat activity was influenced by ALAN in a peri-urban environment, a small-scale impact study utilising commercially available LED (floodlights) was conducted near Tamahere, south of Hamilton City. Changes in mean bat activity in response to periodic illumination were determined using automated bat monitoring units (ABMs; detectors) and compared to activity rates at a nearby control site over ten weeks. There was 32% less activity on lit nights when compared to the unlit nights at the test site (MLR: $p < 0.05$). Bat passes per night were significantly lower (MLR: $p < 0.05$) in the presence of light (mean 45.3 pass/night) compared to the unlit nights (mean 66.7 pass/night). There was no significant difference at the control site between the two light treatments. The time of the first recorded bat call was also delayed by 1:45h during the lit nights compared to the lit nights at the test site, where it only was 0:10h at the control site. These results indicate that ALAN has a negative effect on long-tailed bat activity and behaviour.

Open-habitat specialist experienced population expansion during Pleistocene glaciation and recent decline

Schlesselmann A[1,2], Cooper J[2], Dussex N[3,4,5], Robertson B[2]
[1]Manaaki Whenua - Landcare Research, [2]Department of Zoology, University of Otago, , [3]Centre for Palaeogenetics, [4]Department of Bioinformatics and Genetics, Swedish Museum of Natural History, [5]Department of Zoology, Stockholm University

Biography:
Anne Schlesselmann is a researcher in Conservation Ecology at Manaaki Whenua - Landcare Research in Ōtepoti. After starting a BSc in Landscape Ecology in Germany, she has progressively moved further south and completed a PhD at the University of Otago. She has been lucky enough to work across a wide range of ecosystems and taxa and is excited about applied ecology.

Understanding how climatic and environmental changes, as well as human activities, induce changes in the distribution and population size of avian species refines our ability to predict future impacts on threatened species. Using multilocus genetic data, we show that the population of a threatened New Zealand endemic open-habitat specialist, the Black-fronted Tern *Chlidonias albostriatus* – in contrast to forest specialists – expanded during the last glacial period. The population has decreased subsequently despite the availability of extensive open habitat after human arrival to New Zealand. We conclude that population changes for open habitat specialists such as Black-fronted Terns in pre-human New Zealand were habitat-dependent, similar to Northern Hemisphere cold-adapted species, whereas post-human settlement populations were constrained by predators independent of habitat availability, similar to other island endemic species.

The influence of colour temperature and distance of LED lighting near rivers on adult freshwater insects

Schofield J[1], Harding J[4], Greenwood M[2], Hogsden K[2], Smith B[3]
[1]Consultancy, [2]NIWA , [3]NIWA, [4]University of Canterbury

Biography:
Jessica Schofield completed her Master of Science in Ecology at the University of Canterbury in early 2021 and currently works as an ecologist in consultancy. She has a strong interest in freshwater ecology and her talk focuses on the research conducted during her masters on the influence of LED lighting at night on freshwater insect taxa. She loves the outdoors and enjoyed getting out to do fieldwork for this research in Christchurch and near Arthurs Pass.

In New Zealand, little is known about the effect of artificial lights, such as street and park lighting, on freshwater insects. Light can attract freshwater insects from their flight path along rivers and result in a loss of recruitment back into the river. Across New Zealand, 370,000 streetlights (predominantly high-pressure sodium) have been replaced by energy-efficient light emitting diodes (LEDs). LED lights vary in wavelength profile; shorter wavelengths of light (UV, blue, and green) are more visible to adult insects than longer wavelengths (yellow, orange, and red). Therefore, freshwater insects are expected to be affected more by cooler white LEDs (6500 Kelvin (K)) that have a greater peak in blue light intensity than warmer colour temperatures (3000 K). To gain a better understanding of the influence of LEDs on adult caddisflies, our first experiment compared four white LEDs (3000, 4000, 5650, and 6500 K) at one urban and one back-country river in Canterbury. A second experiment investigated how LED lights at distances between 0- 100 m from rivers affects the attraction of adult caddisflies.

Results show the spectral composition of LED light influences the abundance of caddisflies attracted, as significantly more caddisflies were caught by 6500 K LEDs compared to 3000 K, likewise for 5650 K compared to 4000 K. The number of caddisflies attracted to LEDs significantly declined with increasing distance from the river, consistent across most caddisfly taxa trapped. These results indicate it would be pertinent to include LED colour temperature and position as project design considerations.

Introduced predators influence microhabitat use of large-bodied alpine invertebrates in Fiordland and Rakiura.

Scott-Fyfe T[1], Bertoia A[1], Robertson B[1], Monks J[1]
[1]*University of Otago*

Biography:
Tōrea Scott-Fyfe is excited about all things alpine. Her combined enthusiasm for conservation and climbing lead her to undertake a Masters of Science in Zoology, focusing on the microhabitat use alpine invertebrates and lizards in Fiordland, supervised by Jo Monks and Bruce Robertson. She is now moving to Te Anau to do conservation work closer to the mountains, and plans to spend all her free time in the beautiful granite and moss of Fiordland, hopefully seeing some cool invertebrates, and brainstorming ways to get rid of mice.

Alpine environments exert strong selective pressure on organisms. A key adaptation for alpine conditions is using microhabitats for thermoregulation and feeding. Microhabitats also provide refuges from predation, however time spent avoiding predators can limit use of ideal microhabitats for foraging or thermoregulating. In Aotearoa, the use of microhabitats for thermoregulation has been observed in alpine wētā and lizards, but patterns of microhabitat use by alpine large-bodied invertebrates are poorly understood. Although introduced predators are present in alpine environments, little is known about how they affect ectothermic species, both directly through predation and indirectly through changes in microhabitat use.
We visited eight alpine sites in Fiordland and Rakiura during summer 2021-22. We expected that at sites without predators, invertebrates would be using more open microhabitats. We sampled the invertebrate community using pitfall traps, and collected microhabitat information at each pitfall trap. We used DOC tracking tunnel data to understand the predator community. Our preliminary findings suggest that ground wētā were more likely to be present in open microhabitats where mice were absent. Spiders were more likely to be present in tussock and were not affected by mouse presence. Helm's stag beetle, our largest invertebrate found, was only present on predator-free Secretary Island. Our research indicates that microhabitat use is an important way in which some large-bodied alpine invertebrates can limit the impact of predators. For other large-bodied invertebrate taxa, predation by mammals including mice may be unsustainable; comprehensive predator control may be needed to protect our most vulnerable alpine invertebrates.

Future directions in Conservation Translocations

Seddon P[1]
[1]*University of Otago / Te Whare Wānanga o Otāgo*

Biography:
Phil Seddon is a conservation biologist with a special interest in conservation translocations. He teaches conservation biology and wildlife management at the University of Otago, is a member of the IUCN Conservation Translocation Specialist Group and one of the co-authors of the IUCN Reintroduction Guidelines. Phil is an appointed advisor on several DOC recovery groups, and has been involved in translocation advising, planning, implementation, or review in Aotearoa NZ, Australia, the Middle East, North America, and Western Europe.

In this informal horizon-scanning exercise I reflect on developments in the science of conservation translocations over the last nearly 2 decades, and explore possible future global developments in efforts to establish free-ranging populations for conservation purposes. Inter alia, I will consider the rise of conservation introductions, the use of multi-species and community translocations, applications for rapidly expanding genetic and genomic tools, and the role to be played by conservation translocations in that sprawling enterprise known as "rewilding" - a place where so-called "de-extinction" might have a place.

Effect of kauri dieback on leaf litter nutrient concentrations

Sharma I[1], Schwendenmann L[1]
[1]*The University of Auckland*

Biography:
Isaar is an undergraduate student at the University of Auckland, who is currently completing his final year of a Bachelor of Advanced Science (Hons) in Environmental Change. He has keen interests in forest ecology, and so naturally this thesis was focused on kauri ecosystems. In the future he hopes to complete a PhD, further expanding his interests in forests.

Kauri dieback, caused by *Phytophthora agathidicida*, is threatening the survival of the iconic kauri (Agathis australis) species. Kauri has been found to modify their environment through significant effects on soil processes. Leaf litter is the primary nutrient input to soil, with litter analysis being widely used to assess overall
plant and soil health. The extent of how kauri dieback impacts these processes is largely unknown. This study seeks to identify whether leaf litter nutrient concentrations are impacted through *P. agathidicida* infection. Three sites in the Waitākere Ranges Regional Park have been selected for this study. Macro- (C, N, P, Ca, K, and Mg) and micronutrients (Mn, B, Cu, Fe, and Mo) have been selected for analysis, along with litter biomass and tree size. A comparison of kauri leaf litter to broadleaf litter is also presented, to understand whether nutrient concentrations differ between species of the same forest ecosystem. We observed a significantly higher litter biomass in the site characterized by large trees. We also observed some effects of sample type on nutrient concentrations. Kauri leaf litter nutrient concentrations were significantly higher for carbon, calcium, and the C:N ratio, whilst broadleaf litter was significantly higher for boron and copper concentrations. We did not observe a significant effect of *P. agathidicida* infection, although most kauri leaf litter macro- and micronutrients concentrations tended to be lower underneath trees showing kauri dieback symptoms. Lower litter nutrient input may result in long term changes in biogeochemical processes in kauri dieback affected forests.

Pest Free Auckland: Engaging, involving and enabling communities to lead restoration

Stanley R[1]
[1]*Auckland Council*

Biography:
Bec is a Principal Advisor for conservation partnerships at Auckland Council. Her current role focusses on leading, supporting and influencing increased delivery of landscape scale restoration in collaboration and partnership with a fast-growing conservation community.

Pest Free Auckland (PFA) is an Auckland Council initiative to deliver on biodiversity strategy outcomes to protect and restore the biodiversity of Tamaki Makaurau. It encompasses a range of pest plant, pest animal and pathogen activities in the Region. PFA guides several eradication and suppression programmes and five sanctuaries as well as support for community projects. Resulting in part to the NZ Predator Free challenge the number of restoration groups council supports is increasing, but also group aspirations are broadening. Our response is to engage, involve and enable communities to lead restoration where they live, aiming to both protect and restore biodiversity and invest in the growth of community-powered/community-led conservation. Focussing on Council's support for community led restoration, examples of challenges and successes of the Pest Free Auckland initiative will be presented.

Does urban backyard trapping benefit both bird and human communities?

Gerolemou R[1], Russell J[1], Stanley M[1]
[1]*Waipapa Taumata Rau – University Of Auckland*

Biography:
Margaret Stanley is an Associate Professor in applied ecology at the University of Auckland. Her research primarily focuses on how to mitigate the impacts of invasive species and urbanisation on biodiversity in Aotearoa.

While significant ecological areas have traditionally been the heart of biodiversity management in cities, focus has recently turned to residential areas, primarily through volunteer community conservation groups. One of the main activities of these groups is to encourage 'backyard trapping' of pest mammals as part of the wider remit of Predator Free 2050. But do the enormous efforts to initiate and sustain urban backyard trapping have a net benefit for bird communities? And are there benefits for the people and communities involved in these efforts? We compared bird community composition and nesting success in Auckland suburban backyards with and without pest control. Nests were more likely to fledge at least one chick if they were in a backyard where people checked their pest control devices more regularly, where rat abundance was low, and if they were closer to a significant ecological area. Backyards with pest control were associated with higher bird abundances. We also measured social capital in members versus non-members of Auckland community conservation groups; those involved in community groups had significantly higher social capital, which included more interactions with their neighbours, feeling safer in their community and higher levels of trust. Semi-structured interviews with group leaders showed group members used their trapping group networks to support each other during Covid lockdowns. Our research shows that urban backyard trapping groups can benefit people in cities as well as birds. Moving beyond localised bird benefits will require biodiversity enhancement from a greater proportion of the community, beyond individual backyards.

Biodiversity patterns on atolls: insights into community assembly and ecosystem resilience

Steibl S[1], Ringler D[2], Russell J[1]
[1]*University of Auckland,* [2]*Tetiaroa Society*

Biography:
I am a postdoctoral researcher at the University of Auckland, broadly interested in and fascinated by atolls and their conservation. I began working on atolls over seven years ago, and my research has brought me to different atolls across the tropical Indo-Pacific. Before moving to New Zealand, I did my undergraduate, graduate studies and PhD at the University of Bayreuth in Germany. With my current project at the University of Auckland, I am involved in the Tetiaroa Atoll Restoration Programme, where I investigate the effects on rodent eradication on atoll biodiversity and ecosystem functioning.

Coral atolls form a vast network of islands, stretching across the tropical to sub-tropical Pacific. Because of their tiny land areas, simple habitat structures, and extraordinarily high natural disturbance regimes, atolls are a unique type of island ecosystem and, in many ways, different to the high volcanic islands of the Pacific. The terrestrial biota of atolls are generally considered depauperate and being dominated by widespread generalist species, with low endemism. As atolls consist of multiple separate islets, each islet undergoes its own community assembly. Whether the individual islets of an atoll are replicates of the same community or form a mosaic of different assemblies is unknown. In this talk, we are exploring the alpha, beta, and gamma biodiversity patterns of a Pacific coral atoll from a taxonomic and functional perspective. While alpha (islet-) and gamma (atoll-wide) biodiversity are low, species turnover between the different islets is high. This indicates that each islet harbours its own distinct community, which is likely the result of priority effects that dominate community assembly within atolls. The high species turnover between the islets might also act as a resilience factor for atoll ecosystems, as local disturbances can be compensated through rapid re-colonization of functionally equivalent species from the atoll metacommunity. Importantly for island conservation science, these findings on high species turnover also highlight that atoll islets cannot necessarily be regarded as community replicates. Therefore, the use of different islets of an atoll as control and impact sites needs to consider the inherently high beta diversity.

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Beyond the fences: how does dispersal influence success of reintroductions to connected mainland reserves

Stone Z[1], Parker K[2], Armstrong D[1]
[1]*Massey University,* [2]*Paker Conservation Ltd*

Biography:
Zoe Stone is a posdoctoral research fellow with Massey University looking at how we can monitor and improve reintroduction outcomes in large, connected forest landscapes. This work is park of the 'More birds in the bush' research programme in collaboration with Manaaki Whenua. She has been involved in a range of threatened bird projects in NZ and Australia, focussing on reintroduction biology, spatial ecology and habitat selection for wildlife management.

While Aotearoa has a good record of reintroductions to islands and fenced sanctuaries, efforts to unfenced mainland sites have been less successful. Reintroductions to large, connected, unfenced landscapes are especially challenging. Dispersal is likely a key factor, with vulnerable species moving beyond the protection of managed areas. Poor understanding around the dispersal capabilities for many of Aotearoa's terrestrial species also contributes to high uncertainty reading the outcomes of these reintroductions. Here we present recent work on post-release and juvenile dispersal of toutouwai/North Island robins (*Petroica longipes*) across two large, connected forest landscapes – Turitea Reserve and Taranaki Mounga. We monitored toutouwai using a combination of monitoring methods to determine dispersal range and habitat selection. We successfully tracked most birds within Turitea reserve post-release where birds dispersed over 900 ha of the reserve and settled within a core area of 300 ha. Juvenile dispersal is high at Taranaki Mounga, and only three of the tracked birds were found within the reserve at the end of monitoring. Large sites may adequately capture dispersing individuals, but if predator control cannot be maintained at these scales, translocation outcomes remain uncertain. Post-release monitoring provides invaluable data that can help inform translocation outcomes and is vital for effective, pro-active adaptive management of sites. As larger, connected sites are increasingly targeted for reintroductions, predicting dispersal and habitat selection is crucial to their success.

Spider biodiversity in crop orchard systems | Te kanorau koiora o te pūngāwerewere i roto i ngā pūnaha hauropi huanga kai

Sullivan N[1,2], Vink C[2], Black A[3], Sharp J[1], Marsh A[4]
[1]The New Zealand Institute For Plant And Food Research Ltd, [2]Department of Pest-management and Conservation, Faculty of Agriculture and Life Sciences, Lincoln University, [3]Department of Soil & Physical Sciences, Faculty of Agriculture and Life Sciences, Lincoln University, [4]The New Zealand Institute For Plant And Food Research Ltd

Biography:
Nicola Sullivan is a Senior Research Associate in the Ecological Pest Management team at Plant & Food Research. Nicola studies new insect surveillance systems and pest management and eradication technology using semiochemicals, biotremology, sterile insect technique, and other novel tactics against invasive insects. Nicola is also an interviewer for Plant & Food Research's podcast channel, Scigest. Nicola is currently undertaking an MSc in ecology at Lincoln University on the biodiversity of spiders in crop ecosystems.

Spiders are the dominant, most abundant, and most diverse natural enemies in agroecosystems. They are generalist predators of insect pests, comprising many different functional groups. Spiders contribute economically to crop protection by reducing pest invertebrate numbers both by direct consumption, and non-consumptive effects. Despite this, very few studies on spider biodiversity in crop systems have been completed in New Zealand; moreover, there are no published data on spider biodiversity in New Zealand orchard systems. My master's research aims to answer three questions: 1) What spiders are present in kiwifruit orchards? 2) How does the spider species composition change as native plantings are incorporated into the orchard? 3) What is the consumption rate of one to two spider species of key pest insects? I am addressing these questions through fieldwork and lab studies. During my fieldwork I am using a selection of spider sampling techniques including pitfall traps, active day sampling, active night sampling, and sweep netting. Samples are being collected along a transect that runs from inside a kiwifruit orchard into adjacent native plantings. Lab studies will include consumption bioassays of key spider species found in the orchard with key insect pests found in the orchard. I will measure how many pest insects the spider eats in a certain period to get a measure of consumption rate. This research aims to align with Te Ao Māori goals of Taiao, environmental wellbeing, and contributes to industry goals of spray-free production. Interim results will be presented.

“I want you to want me”: Implications for cat choices and containment in Tāmaki Makaurau Auckland

Sumner C, Bassett I, Ovenden K
[1]*SPCA NZ,* [2]*Auckland Council*

Biography:
As a Science Officer with SPCA, I engage with diverse stakeholders from industry, government, non-profits, and the public on cat management, and on improving the welfare of animals in laboratories, zoos, and the wild. I have worked hands-on with animals in sanctuaries, zoological, and educational settings and a have a research background with people on commercial and smallholder farms. As a researcher, I am interested in understanding what motivates people to change their behaviour to improve animal welfare, and how the human/animal relationship influences their motivation.

Allowing companion cats to roam can negatively impact native wildlife and cat welfare. Preventing cats from roaming is an uncommon practice in New Zealand and little is known about how this is influenced by the owner-cat relationship and perceptions of the local community. We conducted focus groups with cat owners from different areas around Tāmaki Makaurau Auckland to understand these factors. Using thematic analysis, we found owners perceived enabling their cats to make choices is essential for cat welfare; and the owner-cat relationship is shaped by navigating tensions that surround choices. The owner-cat relationship (and choices within) is contextualised by the cat’s characteristics and membership in the local community. Owners providing their cat with the choice to leave home is perceived to be positively associated with enabling their freedom, independence, and curiosity. More critically, the cat’s choice to repeatedly return home reaffirms the owner-cat relationship. Owners perceived cats to belong in many spaces occupied by humans outside of the individual property, but conversely appeared less inclined to perceive native wildlife to belong in these spaces. Efforts to motivate owners to contain their cats need to help owners provide alternative choices for their cats that will meet their welfare needs and foster the owner-cat relationship. Locally relevant strategies aimed at motivating cat owners to contain their cats that consider the owners’ views as members of their community will likely be more successful as there are complex interactions between cats and others in the community.

Newly discovered ecological gaps: six more New Zealand Holocene bird extinctions

Tennyson A[1], Cole T[2], Rawlence N[3], Wood J[4]

[1]Museum of New Zealand Te Papa Tongarewa, [2]Villum Centre for Biodiversity Genomics, Section for Ecology and Evolution, Department of Biology, University of Copenhagen, Ole Maaløes Vej 5, 2200, [3]Otago Palaeogenetics Laboratory, Department of Zoology, University of Otago, [4]School of Biological Sciences, Faculty of Science, Engineering and Technology, University of Adelaide, North Terrace Campus

Biography:

I am a Curator of Vertebrates at the Museum of New Zealand Te Papa Tongarewa. My research focuses on the origin of Aotearoa New Zealand's vertebrate fauna and seabird conservation

In the last ten years, six new extinct Holocene bird taxa have been described from Aotearoa New Zealand; five being from the Chatham Islands / Rekohu / Wharekauri. All became extinct as a result of human colonisation. What ecological roles did they play? The kōhatu shag (*Leucocarbo septentrionalis*) is known from only a few coastal Northland sites. It presumably formed dense nesting colonies on islets and headlands, and foraged only in the adjacent waters. The Chatham Island merganser (*Mergus milleneri*) was a diving, fish-eating duck that was a cave nester on the shore of Te Whanga Lagoon. The Chatham Island kākā (*Nestor chathamenis*) was the only large parrot inhabiting those islands. Its large pelvis and thigh bones suggest that it spent more time on the ground than the mainland New Zealand kākā. The bones of Imber's petrel (*Pterodroma imberi*) are abundant in sand dunes on the Chathams, indicating that the species once nested in huge numbers. Warham's penguin (*Eudyptes warhami*) was a common species on the Chathams and probably formed dense nesting colonies. Richdale's penguin (Megadyptes antipodes richdalei) was a small Chatham Islands relative of the hoiho (*Megadyptes a. antipodes*). *Megadyptes* penguins are solitary nesters and fish-eating benthic foragers, so Richdale's penguin would have occupied a different niche to the similar-sized Warham's penguin, which would have been more of a pelagic crustacean-eater. Penguins and petrels on the Chathams would have been dominant ecological drivers of the terrestrial ecosystem, as they transported large volumes of marine nutrients onshore.

What effects do mammalian predators have on *Geodorcus helmsi* populations?

Thomas L[1], Trewick S[2], Johnson S[1]
[1]*University Of Otago,* [2]*Massey University*

Biography:
I am an entomologist interested in stag beetles ecology. I got my Bachelor's degree in Entomology at Michigan State University and my Masters in Biological Sciences at Northern Arizona University.

The genus, *Geodorcus*, is a endemic group of flightless stag beetles. Most of the species in *Geodorcus* have restricted ranges, with the exception of *G. helmsi,* which is widespread on much of the South Island. Like many native New Zealand fauna, stag beetles have few natural defences against mammalian predators. Rats, in particular, will take beetles and consume them in areas of safety and leave the remains there, creating caches of discarded beetles. During our fieldwork trips to Rakiura/Stewart Island, we were able to make some inferences about the effect of rat predation on stag beetle populations. We measured and used allometric analyses on live beetle and cached heads from two areas with predator control and two areas with no predator control. We found that there were more cached beetles on Ulva Island compared to Mamaku Point and Oban. We also found that cached beetles were significantly larger than the live beetles. While greater replication is needed, our findings suggest that *Geodorcus helmsi* may be an indicator of rodent impacts in a forest and could help identify areas where predator eradication efforts could be focused.

Mapping mycorrhizae with eDNA

van Galen L[1], Orlovich D[1], Lord J[1], Nilsen A[1], Bohorquez J[2], Dutoit L[3], Summerfield T[1], Larcombe M[1]
[1]Department of Botany, University Of Otago, [2]Department of Applied and Environmental Sciences, NorthTec, [3]Department of Zoology, University of Otago

Biography:
Laura van Galen is a recent PhD graduate from the University of Otago where she worked on understanding ectomycorrhizal fungal community ecology and the importance of fungi in forest restoration.

Ectomycorrhizal fungi are one of the most diverse groups of fungi and are widespread throughout New Zealand due to their obligate relationship with tree species such as Nothofagus. However, little is known about ectomycorrhizal species distributions, diversity, community structure and host specificity at the landscape level, partly due to the difficulties of conducting surveys of ephemeral fruiting bodies and identifying cryptic species. eDNA provides an exciting opportunity to more thoroughly survey communities and enhance the conservation prospects of this highly diverse group of organisms. We collected ectomycorrhizal hyphal samples using hyphal ingrowth bags at 808 plots from 81 Nothofagus forest sites spanning the length and breadth of New Zealand's South Island, and characterised communities with high-throughput sequencing. We then used modelling techniques to examine how climate, soil, forest structure and host characteristics influence fungal community assembly processes, and investigated patterns of host-symbiont specialisation. Results revealed interesting differences in the environmental variables influencing the distribution of rare species compared to those affecting more common species. Additionally, patterns of host-symbiont specialisation showed evidence of cophylogeny, i.e., correlated evolutionary patterns between fungi and trees. eDNA also provides the opportunity to increase data availability of individual fungal species' distributions, potentially removing species from the data-deficient list.

A rapid assessment technique for evaluating biodiversity to support accreditation of private gardens

van Heezik Y[1], Seddon P[1]
[1]*University Of Otago*

Biography:
Yolanda van Heezik is a professor in the Zoology Department at the University of Otago, where she teaches wildlife management, harvest management, and conservation biology. Her research interests include mammalian invasive species, wildlife in urban areas, biodiversity of private gardens and urban green spaces, and people's attitudes, motivations and knowledge about biodiversity and their connection to nature. She is also involved in research on marine bird ecology with a focus on penguins.

Garden certification schemes can inform and incentivise householders to enhance native biodiversity in their gardens, but the certification process requires the development of a robust biodiversity evaluation tool that can be implemented over a short time period. We describe the development of such a tool, which used a modified Delphi process and conjoint analysis to identify and rank features associated with biodiversity. We evaluated its performance in 89 residential gardens in South Island, New Zealand. Property sizes assessed ranged from 260m2 to 7195m2. Biodiversity scores ranged between 10-52 out of a possible 100, indicating the challenge of obtaining a score higher than about 60. The relationship between property size and biodiversity score was positive but variable, however all properties <500m2 had scores lower than 30, suggesting a need for a size-specific rating system for smaller properties. Trained assessors evaluated gardens in 1-2 hours, with an additional hour required for collecting information online and performing calculations. Similar scores derived by a second assessor for seventeen gardens (one year later) indicated that the method yields a repeatable score independent of assessor. Garden assessment scores could be converted to a star rating system and adopted by local government, community groups and NGOs, for example, to incentivise homeowners to enhance and sustain backyard biodiversity, to track trends in urban biodiversity, and to help meet regional and national biodiversity strategic goals.

QUAVONZ: The QUAternary Vegetation of New Zealand Database

Vanderhoorn J[1], Wilmshurst J[1,2], Perry G[1]
[1]*University Of Auckland,* [2]*Manaaki Whenua Landcare Research*

Biography:
After doing my Masters on the relationships between the ghost taxon Beilschmiedia tawa other indigenous forest species, I moved down to Christchurch to begin working on the QUAVONZ database with the Long-Term Ecology Lab at Manaaki Whenua Landcare Research. I'm currently in the first year of my PhD, continuing to build QUAVONZ and looking at representation in New Zealand's fossil pollen record with Janet Wilmshurst and George Perry.

There is a global drive to archive palaeodata to (1) protect data against loss over time, (2) standardise existing data and create standards for future research, (3) increase access to data, and (4) allow for exploration and testing of ecological questions across large spatial and temporal extents. The QUAternary Vegetation of New Zealand database (QUAVONZ) is a resource being developed by the Long-Term Ecology Lab at Manaaki Whenua Landcare Research to archive local palaeoecological records and associated radiocarbon dates. New Zealand's vegetation history from the late Quaternary to the present covers a post-glacial shift from grassland/shrubland to forest communities and the later widespread loss of forests following human settlement. Extensive palaeoecological records of vegetation change (fossil pollen, charcoal, macrofossils, etc.) span this period of New Zealand's history, therefore there is great value in linking those local records into a national-scale network to study both past and future change. Analysis of fossil pollen in New Zealand dates back to the 1930s and the current extent of this field is undescribed, with datasets ranging from single undated samples to detailed stratigraphies, published and unpublished, qualitative and quantitative. A starting point for our database is the collection of fossil pollen records held by Manaaki Whenua Landcare research. So far we have compiled metadata for more than 200 sediment profiles, and our next steps will be to standardise the pollen nomenclature, calculate updated age estimates, and compare the distribution of QUAVONZ sites to that of the wider fossil pollen record in New Zealand.

Landscape genomics for Predator Free 2050

Veale A[1], Etherington T[1]
[1]*Manaaki Whenua*

Biography:
Dr Andrew Veale is a wildlife ecologist based at Manaaki Whenua Landcare Research. He completed his PhD in 2013 on the invasion ecology and genetics of stoats on New Zealand's Islands. Since then he has specialised in the applications of genomics to assist in conservation, and in particular on methods to inform invasive species management.

Mustelids (ferrets, stoats, and weasels) and possums are insidious invasive introduced species in Aotearoa, and the New Zealand government has set the ambitious goal of completely eradicating them by 2050. For all these species we need greater knowledge on their dispersal ecology, and how successful our control methods are at landscape scales. In this presentation I will discuss several current research projects where we use landscape genomics to inform and evaluate eradication programs. On Waiheke Island, in collaboration with Te Korowai o Waiheke we have been using Genotyping By Sequencing (GBS) to understand the fine-scale relatedness of stoats on this island to evaluate the success of the eradication campaign. From over 200 individuals sequenced we have been able to create a pedigree for the stoats caught over the 3 year eradication program, providing specific information on the dispersal and trappability of stoats within this trapping network, and we have provided advice on ways to optimise the trapping program. In Taranaki, in collaboration with the Taranaki Regional Council and the Taranaki Mounga Project we have been using GBS to understand the dispersal characteristics of stoats, weasels and possums across this region. We have detected long distance dispersal for both stoats (40 km) and weasels (25 kms) and mapped landscape features that affect possum dispersal using this data. The information gleaned from these studies is both applicable to optimising these specific programs, but also to inform models for other eradication campaigns.

Application of palaeogenetic techniques to historic mollusc shells reveals phylogeographic structure in a New Zealand abalone

Walton K[1], Scarsbrook L[1,2], Mitchell K[1], Verry A[1,3], Marshall B[4], Rawlence N[1], Spencer H[1]
[1]Department of Zoology, University of Otago, [2]School of Archaeology, University of Oxford, [3]Centre for Anthropobiology and Genomics of Toulouse, Université de Toulouse, Université Paul Sabatier, [4]Museum of New Zealand Te Papa Tongarewa

Biography:
Kerry Walton is a mollusc researcher interested in palaeogenetics, phylogeography, biogeography and taxonomy. He is presently a PhD candidate in the Department of Zoology at the University of Otago

Natural history collections worldwide contain a plethora of mollusc shells. Recent studies have detailed the sequencing of DNA extracted from shells up to thousands of years old and from various taphonomic and preservational contexts. However, previous approaches have largely addressed methodological rather than evolutionary research questions. Here we report the generation of DNA sequence data from mollusc shells using such techniques, applied to *Haliotis virginea* Gmelin, 1791, a New Zealand abalone, in which morphological variation has led to the recognition of several forms and subspecies. We successfully recovered near-complete mitogenomes from 22 specimens including 12 dry-preserved shells up to 60 years old. We used a combination of palaeogenetic techniques that have not previously been applied to shell, including DNA extraction optimized for ultra-short fragments and hybridization-capture of single-stranded DNA libraries. Phylogenetic analyses revealed three major, well-supported clades comprising samples from: 1) the Three Kings Islands; 2) the Auckland, Chatham and Antipodes Islands; and 3) mainland New Zealand and Campbell Island. This phylogeographic structure does not correspond to the currently recognized forms. Critically, our non-reliance on freshly collected or ethanol-preserved samples enabled inclusion of topotypes of all recognized subspecies as well as additional difficult-to-sample populations. Broader application of these comparatively cost-effective and reliable methods to modern, historical, archaeological and palaeontological shell samples has the potential to revolutionize invertebrate genetic research.

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

Wehi P[1,2,3], Brownstein G[2], Morgan-Richards M[3]
[1]*University Of Otago,* [2]*Manaaki Whenua Landcare Research,* [3]*Massey University*

Biography:
Cilla Wehi is a conservation biologist based in the Centre for Sustainability, University of Otago. She is a parent of three, and part of the extended Patupō whānau in Aotea.

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 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 tree 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.

Does weed control benefit native plants in limestone ecosystems?

Wotton D[1,2]
[1]Moa's Ark Research, [2]Biological Sciences, University of Canterbury

Biography:
Debra Wotton founded Moa's Ark Research in 2013 and undertakes ecological research and consultancy services to protect and restore native biodiversity. She previously worked for Landcare Research and Department of Conservation. Debra is also a Research Associate at University of Canterbury, where she completed her PhD on seed dispersal by kereru. Debra's research interests include limits to plant recruitment, threatened plants, rare ecosystems, and plant-animal interactions (seed dispersal, herbivory, and seed predation). Debra combines her background in field ecology with cutting-edge statistics, providing robust science to underpin biodiversity conservation.

Limestone ecosystems have declined in ecological integrity, and are widely invaded by weeds. I investigated whether weed control increases vegetation dominance by native species, and the survival, reproduction, and recruitment of critically endangered limestone plants at Lance McCaskill Nature Reserve, Canterbury.

I compared native dominance of cover and species richness in (1) intensively weeded, (2) suboptimally weeded, and (3) unweeded areas. I compared *Ranunculus paucifolius* (Castle Hill buttercup) flowering and seed production in these areas, and in an area treated with Grazon herbicide. I compared *Myosotis colensoi* (Castle Hill forget-me-not) size, flowering, and survival in intensively weeded and suboptimally weeded areas. I also used a seed sowing experiment to compare seedling establishment of *R. paucifolius*, *M. colensoi*, and *Lepidium solandri* (Maniototo peppercress) in intensively weeded and unweeded areas of the reserve.

Weed control increased native dominance of cover and species richness, particularly when intensively weeded. Intensive weeding increased flowering for both species, *R. paucifolius* seed production, and *M. colensoi* size and survival. Recruitment of *M. colensoi* and *L. solandri* was strongly limited by seed supply – seedlings were present only in plots with seeds added. After one growing season, there were more *L. solandri* seedlings in weeded than in unweeded plots.

Weed control can restore native dominance of limestone vegetation and thus limestone ecosystem integrity. Weeding can also increase survival, reproduction, and seedling establishment of limestone endemics. Without weeding, species such as *M. colensoi* may be on a rapid path to extinction, irrevocably changing the composition of limestone communities.

Fine root production and turnover in kauri-dominated forests affected by *Phytophthora agathidicida*

Yang J[1]
[1]*University Of Auckland*

Biography:
Jaynie is MEnvsci student at the University of Auckland/Waipapa Taumata Rau investigating fine roots in kauri-dominated forests. She is interested in plant ecology and conservation with a focus on belowground systems.

Fine roots (≤2 mm in diameter) are major contributors to primary productivity, nutrient cycling, and carbon storage in forest ecosystems. Yet, despite their importance, fine roots are poorly quantified. Kauri (Agathis australis), an ecologically and culturally significant species, is threatened by the pathogen *Phytophthora agathidicida* (PA) causing kauri dieback. Infection begins within living tissue of the fine roots, so knowledge about fine roots is crucial to understanding tree responses to PA. In this study we quantified fine root production and turnover in kauri-dominated forest stands in the Waitākere Ranges Regional Park using root ingrowth cores. Fine roots were sorted into kauri and non-kauri root categories. We found that non-kauri fine root production and turnover were greater than kauri fine roots at most sites, and that kauri fine root production and turnover were significantly greater in sites where the pathogen had not been detected. Our results suggest that the presence of PA shifts the dominance from kauri to non-kauri fine roots. This may have considerable adverse impacts on the functioning of kauri-dominated forest ecosystems.

Combating Phytophthora of kauri dieback: Harnessing plant-microbe interactions through companion planting field trial in Waipoua Forest

Yeoh S[1,2], Gerth M[1,3], Davenport S[4], Davenport A[4], Marsh C[4], Nathan L[4], Hohaia H[4], Deslippe J[1,2]
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Biography:
Su Min Yeoh is a PhD candidate under the supervision of Julie Deslippe and Monica Gerth based in School of Biological Sciences, Victoria University of Wellington. She completed her honours degree studying fungal phylogenetics at the University of Malaya. She then worked on various research projects including protein expression and quantitative proteomics research at the National University of Singapore before moving to Wellington. Her latest research interests revolve around plant and microbial ecology relevant to kauri dieback.

New Zealand's ancient kauri (Agathis australis) forests are under threat from kauri dieback disease caused by the oomycete pathogen *Phytophthora agathidicida*. Harnessing facilitative interactions among plant species, companion planting has proven its synergistic benefits on crop growth, but its application is less understood in ecological restoration of forests. In collaboration with Te Roroa Kauri Ora ranger team, we have established a novel field experiment to trial companion planting treatments for kauri using selected native plants in Waipoua Forest, Northland. Two replicate field trials occur at two types of sites – sites where *P. agathidicida* are confirmed to be present and sites where *P. agathidicida* presence are not confirmed. The companion plant species, karamū (*Coprosma robusta*) and māpou (*Myrsine australis*), were selected based on mātauranga Māori and in vitro confirmation of their anti-Phytophthora activities. A time-of-arrival treatment is included to gauge the temporal efficacy of companion planting surrounding established kauri. We will monitor kauri survival and growth and soil microbial communities quarterly for two years, characterising the response of soil microbial communities through fatty acid methyl ester (FAME) analysis and next-generation sequencing. A mechanistic understanding of tripartite interactions between kauri, native plants, and microbial communities will enable us to determine the efficacy of companion planting in combating kauri dieback and forest restoration. In this presentation, I will report my latest field trial data on kauri survival and growth in response to the treatments.

Seed retention times in New Zealand's largest gecko, *Hoplodactylus duvaucelii* "northern", and implications for seed dispersal

Alena H, Wotton D, Perry G
[1]*The University Of Auckland,* [2]*Moa's Ark Research,* [3]*University of Canterbury*

Biography:
I am PhD student at The University of Auckland in The School of Environment. My research is focused on the effectiveness of lizards as seed dispersers, and combines fieldwork on Aotea Great Barrier Island, molecular ecology, and computational modelling. I am supervised by George Perry and Janet Wilmshurst.

There is significant interest worldwide in how declines in birds and mammals affect species dispersed by frugivory. Fleshy fruits are also an important component in the diet of lizards, and the role of lizards as seed dispersers is beginning to be recognised. For its land area, New Zealand has the largest richness of reptiles globally; thus, seed dispersal by reptiles may be more common than elsewhere. Seed retention time (the period between ingestion and defecation) along with animal movement determines how far a seed will be dispersed from the parent plant. We aimed to add to the limited knowledge on seed dispersal by lizards in New Zealand, particularly the lack of seed retention times. Seed retention times were investigated in 92 captive *Hoplodactylus duvaucelii* "Northern" (Duvaucel's gecko). The geckos were offered fruits from 10 different plant species. Fifty-one geckos consumed fruits, and the mean seed retention time was 69 hours and ranged from 30 to 145 hours. There was no significant difference between the mean seed retention time in males and females, but juvenile geckos had significantly shorter mean seed retention times. There was a significant positive relationship between seed retention time and gecko body mass. We estimate seed retention times in other New Zealand lizards and suggest those with body mass above 20 grams could easily disperse seeds over 10 m away from the parent plant. Future studies could combine seed retention times with movement data to estimate seed dispersal kernels for many New Zealand lizards.

Investigating myrtle rust in Aotearoa: Pathogen spillover and spatial patterns

Balfour N[1,2], Bartlett M[1], Schwendenmann L[2], Zhulanov M[1], Gillard K[1], McCarthy J[3], Soweto J[1], Somchit C[1,4], Fraser S[1]

[1] Scion, New Zealand Forest Research Institute, [2]The University of Auckland, [3]Manaaki Whenua - Landcare Research, [4]Agresearch, Ruakura Agricultural Centre

Biography:

I am an MSc student at The University of Auckland and the Crown Research Institute Scion, investigating the ecology and population genetics of the fungal pathogen Austropuccinia psidii in Aotearoa's native ngahere (forest). As I grew up in Tāmaki Makaurau near Te Wao Nui o Tiriwa, the well-being of the ngahere is integral to my identity. My broad research interests include ecology, evolution, invasion biology, landscape genetics, restoration ecology and environmental science. I am also passionate about equity, well-being and diversity in education and research. After completing my master's, I will pursue a PhD overseas.

Invasive pathogens threaten ecosystems worldwide and there is growing urgency to understand their impact and spread. When a multi-host pathogen invades, inoculum build-up on highly susceptible species can lead to 'spillover' of disease onto less susceptible co-occurring species. The pathogen *Austropuccinia psidii* (causal agent of myrtle rust), infects numerous species in the Myrtacaceae plant family and was detected in Aotearoa in 2017. Early in the invasion the disease appeared to primarily impact species in the *Lophomyrtus* genus, however severe infection is increasing on a range of Myrtaceae, potentially indicating pathogen spill-over.

We investigate the evidence for pathogen spillover between *Lophomyrtus* bullata and the climbing rātā species, *Metrosideros diffusa*, *Metrosideros fulgens* and *Metrosideros perforata*. We established forest plots across a range of L. bullata and rātā densities at three native forest sites, assessing forest structure, host abundance and disease severity. Data analysis is in progress; preliminary results suggest a spillover effect at two sites, as indicated by a positive relationship between disease on *L. bullata* and disease on *M. diffusa* and *M. fulgens*. No infection was detected on *M. perforata*. Furthermore, landscape-level infection patterns are emerging, potentially reflecting disease dynamics related to forest edge effects, or site-scale host densities. Our preliminary findings extend knowledge on the risk of myrtle rust and the role of ecological connectivity in pathogen invasion. These results provisionally suggest minimising forest fragmentation and removing inoculum sources could be an effective strategy to promote forest resilience and mitigate disease impact and spread.

Manaaki whenua. Manaaki tangata. Haere whakamua.

Detection and habitat associations of katipō (*Latrodectus katipo*) in Bream Bay, Northland, New Zealand

Pepperell D[1], Carr L[2], Griffiths R[2], Hansen K[2], Ball O[1]
[1]NorthTec-Te Pukenga, [2]Northland Regional Council

Biography:
Dūnyam (nǧati porou, nǧati kuri) completed their Bachelor's of Applied Science (Biodiversity Management major) at North Tec - Te Pukenga in 2021, where they focused their research activities on katipō conservation. They are currently monitoring bats in southern England and hopes to carry on increasing community awareness of the many environmental issues facing us today with combining indigenous and western science.

Olivier Ball has been a tutor in the Applied and Environmental Sciences Department at NorthTec since 2000. His research interests centre on taxonomy of terrestrial amphipods and invertebrate community ecology.

The endemic New Zealand widow spider katipō (Latrodectus katipo) is listed as At Risk – Declining. This study used manual searching and artificial cover objects (ACO's) (initially deployed to monitor lizards) to monitor katipō in the mid-dunes and fore-dunes at Bream Bay, Northland, and investigate environmental predictors of presence and abundance. Manual searching and ACO zones were arranged along transect lines at several sites across Bream Bay. Manual searching was conducted in the fore-dunes and involved searching all vegetation and solid debris (mainly driftwood) by hand. ACO's were mainly located in the mid-dunes in areas with low vegetation (primarily exotic ice-plant and grasses) and checked for katipō three months after emplacement. On average, four katipō/1000m2 were detected by manual searching across all sites. This appears considerably lower than at other sites within New Zealand for which data are available. Katipō were located on all parts of the foredune, indicating no strong habitat preference across the dune profile. Most spiders (75%) were associated with spinifex (Spinifex sericeus), which was also the dominant plant species present. However, a significant proportion (13.8%) were found under driftwood, despite the very limited quantities of this resource. Eleven Katipō occupying 16.7% of ACO's (all in the mid-dunes) were found, indicating the exotic ice-plant/grass matrix represents a useable habitat. Together, these observations suggest solid cover is a key habitat variable for katipō and indicate the likely importance of driftwood management as well as the use of artificial cover in the monitoring and conservation of this taonga species.

Short-term response of vegetation to fire in grasslands is predictable despite long-term community change, Lake Ōhau

Budha-Magar S[1], Buckley H[1], Day N[2], Curran T[3]
[1]Auckland University Of Technology, [2]School of Biological Sciences, Victoria University of Wellington, [3]3Department of Pest-management and Conservation, Lincoln University

Biography:
She is a botanist, an ecologist, and a PhD student at Auckland University of Technology, Auckland. Her research focuses on predicting the behavior of fires in New Zealand's indigenous tussock grasslands. Using a wide range of long-term vegetation monitoring data spanning one month to nine decades, she is investigating how plant communities and plant traits change both temporally and spatially over time and their impact on future fires. Her research is financially supported by The Miss E. Hellaby Indigenous Grasslands Trust and AUT for her PhD.

Wildfire activity is increasing globally due to effects of climate change, including in ecosystems where fires were previously rare. Wildfires impact on ecological and evolutionary dynamics of many ecosystems, including changes in plant community structure. Understanding responses immediately after fire with knowledge of background vegetation dynamics over the long term enables us to understand the true impact of fires in ecosystems where native species evolved without fire. However, long-term data are often not available. We aimed to investigate plant community resilience to fire in tussock grasslands in the South Island, New Zealand, in terms of community recovery after wildfire. Regularly measured permanent vegetation transects at Lake Ōhau (n=3, est. 1983) burnt in October 2020 were re-measured three times after fire (1, 5, and 15 months). We compared plant community structure, including species' traits across time to determine long-term dynamics and short-term responses to wildfire. Results showed that, although these grassland communities are relatively dynamic on decadal timescales, changes in community structure caused by wildfire were significant. Vegetation had almost recovered to pre-fire community structure in 15 months after wildfire suggesting resilience. Native plant species were more diverse than exotics and had a relatively stronger negative response to fire. Species' traits (community flammability: from individual shoot-level estimates) changed significantly over time, where flammability change was related to change in community structure. Our study suggests plant communities in tussock grasslands are relatively resilient and able to recover rapidly. However, increased fire activity may lead to increases in exotic species because they are highly resilient.

Strengthening the ecological scientific foundation of regulatory frameworks - integrating 'biodiversity/conservation' and 'environmental' perspectives

Dinica V[1]
[1]*Victoria University Of Wellington*

Biography:
Valentina Dinica is Associate Professor in Public Policy and Sustainability. Since 1999, she has been teaching on topics such as: governance for sustainability and resilience; environmental policy; sustainable tourism; Protected Area governance; renewable energy policies; policy analysis: theory and methods; participatory policy processes. Valentina is a member of the Tourism and Protected Areas specialist group of the IUCN's World Commission for Protected Areas.

She was been the Convenor of the Environmental Policy and Politics Network of the New Zealand Political Studies Association (2017-2021). She served as member of the Steering Committee for the university's Distinctiveness Theme on Sustainability and Resilience.

The current biodiversity and environmental crises in New Zealand have been facilitated by ineffective and fragmented regulatory and institutional frameworks. While developed ad-hoc and in the shadow of socio-economic interests, a major drawback has to do with their relationships with science.
Reductionist and narrow conceptualisations of nature are visible in the administrative boundaries between, and laws being implemented by, the Ministry for the Environment, the Department of Conservation (DOC) and local/regional councils. In 'conservation law', nature is too often reduced to iconic or socially/culturally-important species/habitats, at the expense of ecological processes and ecosystem services. Except for ecosystem integrity and restoration/rehabilitation (which are not always feasible anymore), visions for other ecological performance values and ecological objectives have not yet been articulated.
'Environmental' regulations focus on the protection of abiotic elements, with a recent further segregation of climate regulations from them. The Government is working to replace the country's Resource Management Act. But reductionist and narrow understandings of nature still characterise the draft legislation. The Conservation Management Reform project lead by DOC (2021-2025) appears focused on patching gaps in the traditional 'conservation law'.
This presentation articulates options for legal and policy innovations, taking a holistic approach to ecological protection. Recommendations draw on contemporary scientific understandings of socio-ecological systems. They also utilise ecological concepts proposed in international law and deemed feasible from legal and implementation perspectives. The presentation explains how new sets of 'ecological values' and 'ecological objectives' would be more effective at protecting nature. It also illustrates how they can be operationalised in regulating human access to areas of different ecological vulnerability/resilience. This is done by suggesting how to update regulatory tools such as Environmental Impact Assessments, Strategic Environmental Assessments and the ecological terms and conditions for human activities and infrastructures.

Smelt diet composition across salinity gradients in coastal Rēkohu lakes

Fortune-kelly G[1], Ingram T[1], Ara M[1]
[1]*University Of Otago*

Biography:
I am a passionate freshwater ecology postgraduate student who is fascinated by the complexity of the natural world. I grew up in Aotearoa and spent a couple of years travelling before studying at Otago University. I completed my BSc at Uppsala Universitet, and am now doing a MSc at Otago. My research focusses on freshwater food web structure in coastal lakes on the unique island of Rēkohu (Chatham Island).

Sea level rise threatens ecosystem structure and function in coastal lakes by increasing salinity, altering community composition. As mobile generalists, fish have a key influence on the stability of a system, impacting trophic network structure. Understanding their diet across abiotic gradients, such as salinity, can show key characteristics of their ecological role, and shifts in predator diet may serve as warning signs of system-wide network reconstruction. We have been using stomach contents analysis to look at the diet of an important and widespread fish (*Retropinna retropinna*; common smelt) across the unique and understudied lakes of Rēkohu (Chatham Island). Smelt stomachs from 10 lakes (seven freshwater and three salt-influenced) were analysed. Diet between salt-influenced and freshwater lakes showed shifts in taxonomic and functional composition. Smelt in freshwater lakes predominantly consumed herbivorous, omnivorous, or predatory insect larvae (Trichoptera and Diptera). Conversely, diet in salt-influenced lakes was dominanted by crustacean shredders (Amphipoda and Isopoda). The between lake taxonomic variation amongst salt-influenced lakes was lower than between freshwater lakes, suggesting homogenistation of smelt diet with salinity. A range of smelt total niche width and individual specialisation estimates were observed across the lakes, with no clear trends relating to salinity. Given the increasing threat of sea level rise to the many low altitude coastal lakes on Rēkohu, further development of knowledge on trophic structure across salinity gradients is essential in understanding ecosystem function under future climate scenarios.

Robustness of pollinators against orchid sexual deceit and ghosts of mutualisms past.

Martin A[1,2], Gaskett A[2], Kokko H[3], O'Hanlon J[4], Wood J[5]
[1]Manaaki Whenua - Landcare Research, [2]The University of Auckland, [3]The University of Zurich, [4]The University of New England, [5]The University of Adelaide

Biography:
Amy is a current post-doc at Manaaki Whenua - Landcare research. She is interested in all things natural history, especially weird and hard to explain relationships.

Pollination is not always mutualistic, and some plants can impose costs on their pollinators. Tongue orchids are extreme deceivers, achieving outstanding pollination rates while eliciting ejaculation from their male wasp pollinator. My PhD asked: with this cost, how do populations persist?
We found that at sites with natural populations of orchids, males have longer antennae, but this did not correlate with improved avoidance of orchids as might be expected via counteradaptation. Instead, males might be under selection to respond faster to signals than avoid deceptive interactions. I present a novel mechanism to explain this: robustness. Using mathematical modelling, we demonstrate that a putative trait that confers robustness, haplodiploidy (in which females can reproduce without sperm, albeit only sons), helps exploited pollinator populations persist when deceived, via the ability of unfertilised females to reproduce, albeit having only sons.
I also introduce new work being done, for my post-doc, on another odd relationship: Aotearoa-NZs truffle-like fungi. Here, in New Zealand, we have an abundance of brightly coloured, above ground truffle-like fungi (that have no obvious mechanism for dispersal). Could this be a remnant of a past mutualism?

Effect of *phytophthora agathidicida* infection on kauri leaf nutrient content.

Hamilton Murray M[1], Schwendenmann L[1], Padamsee M[1]
[1]*University Of Auckland*

Biography:
I am a current Master's student at the University of Auckland where I have also completed BA, BSc, and PGDipSci degrees. I have a fascination for all components of the natural world, but am particularly concerned with conservation issues in Aotearoa. My upbringing in Waitākere fostered a deep appreciation for kauri forests, and I am grateful to Te Kawerau ā Maki for facilitating this research, which I hope will contribute to our understanding of the impacts of P. agathidicida *on kauri forest ecology.*

Infection of kauri (Agathis australis) by the oomycete *Phytophthora agathidicida* causes damage to the tree through the colonisation of roots and vascular tissue, and the consequent restriction of water and nutrient transport through the tree. In the canopy, symptoms of disease from *P. agathidicida* infection include foliage discolouration and thinning, suggesting that biochemical changes are occurring within the leaves.

This research aims to understand how *P. agathidicida* infection impacts the nutrient status of kauri leaves. To this end, fresh leaves were collected from kauri at six plots across three sites in the Waitākere Ranges during late Summer, 2022. In total, leaves from twenty-four kauri trees were collected from the upper and lower canopy. Leaves were then analysed for carbon, nitrogen, and macro- and micro-nutrient content, while leached nutrients and microbial presence were assessed from the leaf surface.

Soil samples collected over this same period detected *P. agathidicida* in the soil of roughly sixty percent of the study trees. Preliminary findings suggest an effect on leaf macronutrients where *P. agathidicida* is detected, including reduced calcium and potassium quantities. Such changes to the nutrient status of kauri leaves have the potential to influence processes of the wider forest ecosystem.

Future steps for this project include investigating whether phyllosphere bacterial and fungal communities differ with infection status, and whether a relationship exists between leaf nutrient content and microbial community composition.

Optimally managing threats to biodiversity across large scales

Hanson J[1], Delsen D[2], Binley A[1], Allan J[2], Jung M[3], Visconti P[3], Hermoso V[4], Schuster R[1,5], Chapman M[6], Bennett J[1]

[1]Department Of Biology, Carleton University, Ottawa, Canada, [2]Institute for Biodiversity and Ecosystem Dynamics (IBED), University of Amsterdam, Amsterdam, The Netherlands, [3]Biodiversity and Natural Resources Program, International Institute for Applied Systems Analysis (IIASA), Laxenburg, Lower Austria, Austria, [4]Departamento de Biología Vegetal y Ecología, Facultad de Biología, Universidad de Sevilla, Sevilla, Spain, [5]Nature Conservancy of Canada, Toronto, Ontario, Canada, [6]University of California, Berkeley, United States

Biography:

Jeffrey Hanson is a postdoctoral scientist at Carleton University, Canada. His research focuses on helping practitioners and policy makers make better conservation decisions. His work explores how optimization algorithms (e.g., integer programming), novel datasets (e.g., genomic data), and data collection programmes (e.g., ecological surveys, monitoring) can help identify priority areas for conservation management. To make his research accessible, he also develops data processing and decision support tools (e.g., prioritizr, raptr, oppr, wdpar R packages). For more information, see his website: http://jeffrey-hanson.com.

Biodiversity is impacted by anthropogenic threats. These threats are myriad, including agriculture, energy production, mining, pollution, and roads. Since resources are limited, plans for conserving biodiversity need to be cost-effective. Yet little guidance exists for prioritizing conservation efforts to manage threats—especially at national and continental scales. Here we examine strategies for managing threats to biodiversity across such large scales. Using Europe as a case study, we obtained spatial distribution, habitat affiliation, and threat data for the majority of imperiled vertebrate species. We also obtained maps for eight threatening processes. By combining these datasets, we modeled how abating combinations of threats in particular places would improve species' habitat availability. To minimize anthropogenic conflicts, we also parametrized opportunity costs. After compiling these data, we generated optimized conservation plans to (i) manage threats inside and outside existing protected areas, (ii) manage threats only within existing protected areas, and (iii) establish protected areas without abating threats. Our results reveal priority areas for abating threats to improve biodiversity conservation. Not only do our results help identify the most cost-effective locations for conservation efforts, they also identify which threats are important to manage at each of these locations. We found that managing threats both inside and outside existing protected areas provides much greater conservation benefits than only within existing protected areas. Moreover, even when optimized, simply establishing protected areas without abating threats did not substantially improve biodiversity conservation. Our findings highlight the importance of carefully considering threats in conservation assessments and planning.

Avian disperser sensory may drive the convergent evolution of New Zealand's native fruit and truffle-like fungi (TLF)

Johns G[1], Gaskett A, Brunton-Martin A, deRegnier R
[1]*The University Of Auckland,* [2]*Manaaki Whenua*

Biography:
Kia ora,
My name is Gabrielle and I am a Master of Science student of the University of Auckland within the Ecology and Evolutionary Biology department. My Master's thesis focuses on avian disperser sensory and how this may drive the convergent evolution of New Zealand's native fruit and truffle-like fungi. I look forward to sharing my enthusiasm for this project and piquing your interest in this topic :)

Some fungi may use animal vectors for spore dispersal. Animal-dispersal ecology requires cues from signallers and signal reception by dispersers. The evolution of specialized signal cues is driven by the receiver's ability to detect colours, sounds and smells. If ectomycorrhizal fungi have evolved signals to attract animal spore-dispersers, these signals should match disperser's sensory systems. Globally, truffle-like fungi (TLF) are generally dull-coloured, strong-scented and subterranean, matching mammalian behaviour and sensory preferences. New Zealand's (NZ) faunal ecology, however, is uniquely dominated by birds and reptiles. Here, TLF are brightly coloured, forest floor emergent sporocarps, which may resemble the fruits of native flora. I hypothesise that NZ's TLF and fruiting plants evolved convergent visual cues in response to the sensory ecology and selection pressures imposed by endemic bird dispersers. Here I share the spectral reflectances of several species of NZ's TLF and fruits from sympatric plants, and model TLF spectral reflectances into vision systems of various birds to test for any colour similarities, and how they stand out against the forest floor. The convergent evolution of NZ's TLF provides an interesting perspective on how fruit traits are tailored for dispersal by endemic fauna.

Nosestradamus- solving a mushroom mystery using sensory traits

Lee G[1], Gaskett A[1], Brunton-Martin A[1,2]
[1]University Of Auckland, [2]Manaaki Whenua - Landcare Research

Biography:
I completed my BSc(Hons) at the University of Auckland investigating possible dispersers of truffle-like fungi, and just this year started a PhD looking at the sensory ecology of Aotearoa's many skinks and geckos. My PhD will focus on what they see and what they smell, as well as how they look (but not how they smell).

Aotearoa New Zealand has over 250 species of truffle-like fungi with enclosed spores that have no active method for dispersal, much like their true-truffle cousins. Elsewhere, truffles tantalise mammal dispersers with irresistible aromas and are remarkably unremarkable in their dull colouration. Aotearoa's truffle-like fungi are reds, oranges, and purples. Could they resemble fruit to attract our (mostly) visual native birds as dispersers?
I explored whether our fungi are fruity to attract birds by a) testing if the distributions of colourful truffle-like fungi overlap with birds that might disperse them, and b) if birds that eat brightly coloured food (e.g. fruit) have any particular suite of sensory traits.
The birds that most overlapped with truffle distributions were karearea, pīwakawaka, and toutouwai.
Though toutouwai have been observed snacking on the occasional fruit, karearea and pīwakawaka are strictly carnivorous and insectivorous respectively. My global analysis of bird traits and diet found that larger olfactory bulbs are associated with foraging in forests (e.g. fruits), and near water (e.g. fish).Frugivores had the largest olfactory bulbs and nostrils. Carnivores had the largest eyes. Surprisingly, there was no evidence of any negative trade-off when directly comparing visual and olfactory traits. Amongst Aotearoa's birds, the biggest relative eyes are found in karearea and toutouwai. Nostrils are largest for kereru (frugivore). Tieke have relatively large eyes and nostrils, perhaps reflecting their omnivory. In general, worldwide, the greatest predictor of bird frugivory was not the size of any particular sensory feature, but habitat.

Disentangling the indirect effects of nitrogen enrichment on small scale insect and fungal pathogen damage in grasslands

Mannall T[1], Daniel C, Kempel A, Allan E
[1]*Institute of Plant Sciences, University of Bern,* [2]*Swiss Federal Institute for Forest, Snow and Landscape Research,* [3]*Oeschger Centre for Climate Change Research*

Biography:
Tosca Mannall is a community ecologist and current PhD candidate at the University of Bern in Switzerland. She completed her bachelors and honours degrees at the University of Otago, before moving to Bern. With a key focus on global change and land use intensification, her research aims to disentangle the mechanisms by which nitrogen addition affects grassland insects and fungal pathogens, and their subsequent impact on plant communities.

Insect herbivores and fungal pathogens are key plant enemies that have large impacts on diversity and ecosystem functioning. Understanding the mechanisms behind effects of global environmental change on these groups is therefore critical. Here we aimed to disentangle the indirect effects of nitrogen addition on leaf damage by four guilds of invertebrate herbivores and foliar fungal pathogens, using the PaNDiv grassland experiment located in Bern, Switzerland (47°03'N, 7°46'E, 564 m a.s.l.). This factorially designed grassland experiment manipulates nitrogen, plant species richness, plant functional composition and fungicide. Allowing us to test the relative importance of the growth defence trade-off and host concentration hypotheses against the increase in foliar nitrogen, on influencing consumer damage at different scales (40cm∅ and 3m2).
Overall, the impact of the indirect effects of nitrogen enrichment had varying effects on consumer guilds across different scales, primarily due to differences in consumer specialisation and dispersal mechanisms. We found evidence that shifts in plant community composition had a greater influence on consumer damage than the increase in foliar nitrogen itself. We provide support for the growth-defence trade-off hypothesis as the most consistent driver of consumer damage across guilds, however resource concentration effects were the strongest driver for fungal pathogen infection. Additionally, the interactions between the indirect effects of nitrogen were found to be more important in determining consumer damage, at the larger scale, than the indirect effects alone.

Pest fish control in an urban wetland: Travis Wetland, Christchurch

Mccaughan H[1], Skilton J[2]
[1]*Department Of Conservation,* [2]*Christchurch City Council*

Biography:
Helen McCaughan has a Master of Science degree and has worked in conservation and freshwater ecology for approximately 20 years. Helen has recently returned to the Department of Conservation (DOC) after spending one year working as a Biodiversity Officer for a Regional Council and five years working as a Freshwater Ecologist in the private sector. She has previously worked for DOC in various regions nationwide, as a Biodiversity Ranger and then a Freshwater Technical Advisor. She is currently working for DOC in a national freshwater role, with a focus on South Island freshwater biosecurity.

Travis Wetland is connected to the Avon River/Ōtākaro and is the largest freshwater wetland remaining in Christchurch/Ōtautahi. On retirement from farming the wetland was proposed for residential development, but a group of locals wanted it restored and formed the Travis Wetland Trust to work with the Christchurch City Council. Over the last 30 years large community planting days have been held, hydrology has been modified, predator and weed control undertaken, and some native animals reintroduced. In 2008 the introduced fish rudd (*Scardinius erythrophthalmus*) was found in the wetland. Rudd can have devastating impacts on freshwater ecosystems through their feeding, habitat use, and prolific breeding, and are classified as a Noxious Fish in most of Aotearoa/NZ. The City Council and Department of Conservation worked together to control the rudd, with the support of The Trust. A consistent method of set-netting was established, and several years of work has culminated in the numbers reducing from an initial catch of 382 down to zero for all of the last nine seasons. During the fish netting, data was collected to optimise time of control in relation to spawning and peak summer fish activity. Environmental DNA sampling has been added to the monitoring over the last two seasons.

Kaka and bellbird distribution across the Kiwi Coast in summer 2016 and 2021

Morgan D[1,2], Ambury W[2], Sullivan N[2]
[1]*Northland Regional Council,* [2]*Kiwi Coast Charitable Trust*

Biography:
Dai is a birder who kills a few rats and possums on the side. He is a Northland boy and loves being back home working with community-led conservation projects.

The Kiwi Coast is a collaborative initiative that links and supports many of the community-led conservation projects in Tai Tokerau/Northland. To help quantify the success of mammalian predator management within these projects, an 'Indicator Species Monitoring Program' has been established where several iconic Northland birds are repeatedly surveyed using different protocols and at different frequencies. Kaka and bellbird / korimako are two of the species in this monitoring program and both are relatively rare in Northland. Between January – February 2016, their presence or absence was recorded in 25 sites across Northland using a specifically developed survey protocol. Between January – April 2021, the same protocol was repeated at 35 sites (23 of which were visited as part of the 2016 survey) to investigate whether the distribution of these species has changed. In 2016, bellbirds were only detected at one site and in 2021 they were again detected there; however, this species were also observed at an additional five locations. Kaka were only detected at one site in the 2021 survey but were present in three different sites in 2016. Despite the slight changes in the numbers of sites that detected or did not detect these species, the data suggest that the distribution of kaka and bellbird are still very restricted across Northland. If mammalian predation is limiting these species, it is hoped that with continued predator management the distribution of these species will be greater when the surveys are repeated in 2026.

Large-scale and long-term restoration in theory and practice: lessons from mid to late successional forest landscapes

Morse H[1]
[1]*Victoria University Of Wellington*

Biography:
Hiya, I am a PhD student at Victoria University of Wellington and my research focus is in the combined ecological processes of restoration, forests, and landscapes. The combination of practical application and basic research is what draws me to the study of the way these three areas intersect.

My poster will present the in-progress work of my PhD on restoration at the landscape scale of forest ecosystems. I will share the background and process of each chapter with as much up to date information as has been completed by the time of the conference. My first chapter models forest species ranges under multiple scenarios of climate change (are we planting for restoration in a climate smart way?). The second chapter presents field data I have recorded on the progression of old restoration sites (what unplanted species are colonising restoration sites as they age?). The third chapter models the ecosystem service impacts of realistic landscape-scale restoration (what are the potential ecosystem service impacts of (1) nationwide riverbank restoration and (2) nationwide unproductive land conversion to indigenous forest?). By sharing this unpublished work I hope to engage in discussion with those interested in these fields and gain practice in data presentation.

Pōhutukawa leaf functions and characteristics following *Austropuccinia psidii* infection

Nguyen H[1], Schwendenmann L[1], Padamsee M[2], Bellingham P[2]
[1]*The University Of Auckland,* [2]*Manaaki Whenua Landcare Research*

Biography:
I graduated with a BSc in Environmental Technology from Hanoi University of Science in Vietnam in 2008. I completed my Master of Environmental Management at Flinders University, Australia, in 2017. For my MSc thesis, I estimated greenhouse gas emission from solid waste landfill sites in Vietnam. My PhD research is on the ecological impacts of myrtle rust, an airborne fungal pathogen that infect many species in the Myrtaceae family. I am mainly focusing on the effect of the pathogen on carbon, water and nutrient fluxes at the plant and ecosystem level.

Myrtle rust (*Austropuccinia psidii*), is one of the world most concerning foliar biotrophic fungal pathogens because it infects numerous Myrtaceae plant species worldwide. The pathogen infects young, actively growing tissues such as new leaves, floral buds, shoots, and fruits. Myrtle rust infection may cause significant changes in functional traits of the host at both tissue and plant level. Previous studies have shown that foliar pathogen infection reduces photosynthesis rates and modifies the chemical content of the infected leaves and other tissues.
We investigated the effects of *A. psidii* infection on leaf photosynthetic rates, stomatal conductance, and chemical content (carbon, nitrogen) of pōhutukawa (*Metrosideros excelsa*) seedlings. The study was conducted in a glasshouse over 16 weeks with two treatments (infected and uninfected control). Disease severity of the infected cohort increased significantly over time. Photosynthetic rates in infected seedlings were significantly lower than controls and the reduction in photosynthetic rates were proportional to disease severity. In contrast, stomatal conductance of infected seedlings versus controls decreased over the first four weeks following inoculation and then increased. Leaf carbon content of infected seedlings decreased slightly over time most likely due to the reduction in CO_2 assimilation rates. Leaf nitrogen content of infected seedlings varied over time. The results highlight that *A. psidii* colonization and growth inside the leaf causes a detrimental effect on pōhutukawa leaf functions and characteristics which may lead to long-term changes in plant and ecosystem processes.

Assessing the Effect of Phosphite Treatment on Arbuscular Mycorrhizal Fungi in Kauri (*Agathis australis*)

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Biography:
Haileigh Patterson is a graduate student at University of Auckland. She completed her Bachelor of Science at Victoria University and is currently studying towards her Honours degree at the University of Auckland. She has an interest in plant pathology and native forests, particularly kauri dieback.

Kauri (*Agathis australis*) is a keystone, culturally significant endemic New Zealand tree species. Kauri are threatened by *Phytophthora agathidicida*, the oomycete that causes kauri dieback. Kauri dieback is treated with phosphite, which is commonly used in agriculture. Phosphite has been an effective short-term treatment, however its long-term use is uncertain. There is concern for the lack of research on the effect of phosphite on the arbuscular mycorrhizal fungi (AMF) associations that exist in a symbiotic relationship with kauri roots. AMF are integral for kauri health, serving to aid metabolite uptake in nutrient-poor soil and confer pathogen resistance, among other functions. My study investigated the effects of phosphite injection on AMF within kauri roots and nodules. Twenty trees from two plots in the Waitākere Ranges were sampled. The plots were treated with phosphite in 2018 and 2019, and one of the plots was symptomatic for *P. agathidicida*. To investigate the effect of phosphite treatment, the species diversity of AMF across all trees was characterised using high-throughput DNA sequencing, and colonisation rates were determined for select tree samples. Additionally, the soil characteristics of all tree sites were assessed. Given the importance of AMF for the health of kauri, this research is integral to inform the continued use of phosphite in treating kauri dieback.

Dispersal patterns of a South Island robin/kakaruai (*Petroica australis*) population out of a predator-free sanctuary with high habitat fragmentation

Pearmain-Fenton M[1], Pickerell G[1], Monks J[1], Schlesselmann A[2]
[1]*University Of Otago,* [2]*Manaaki Whenua - Landcare Research*

Biography:
Manaia (Ngāti Awa) is an MSc Zoology student at the University of Otago, supervised by Dr Joanne Monks & Dr Anne Schlessemann. In 2021, she completed her BSc (Honours) at Curtin University in Perth, Western Australia focusing on predation stress in honeyeater species. Her research interests focus on avian behavioural ecology and engaging rangatahi as kaitiaki in citizen science. She is passionate about incorporating and developing Mātauranga Māori within the zoological research space.

Dispersal is an essential behaviour that allows individual birds to find new habitats despite the changing environmental conditions of location, season, or year. The most common form of movement is natal dispersal, where young birds move from where they fledged to where they first attempt to breed. However, this movement can only happen when there is an appropriate level of connectivity between suitable areas. For bird populations inside fenced ecosanctuaries or artificial 'island ecosystems', having access to suitable habitats is critical for their reestablishment into non-fenced areas and, ultimately, population survival. We focused on a single South Island robin/kakaruai (*Petroica australis*) population residing within Orokonui Ecosanctuary, first translocated from Silver Peaks and Flagstaff in 2010. In 2022, we replicated surveys encompassing areas of both remnant and revegetated habitats adjacent to the sanctuary boundaries, which were first conducted during the 2018 and 2019 breeding seasons. We then compared the results over spatial and temporal gradients. For a species to successfully 'spill over' out of fenced ecosanctuaries, there must be suitable habitats and means to reach them through connective habitat corridors. However, simply dispersing into new habitats is only helpful if individuals can establish breeding territories and produce offspring. In this study, we aim to investigate if a fenced population can successfully re-establish itself throughout a highly fragmented surrounding landscape. We then argue that maintaining areas of appropriate, accessible habitat in which predators are sufficiently suppressed outside ecosanctuaries is crucial for the persistence of many dispersing bird species.

Environmental effects on root biota of *Discaria toumatou*

Pekelaar S[1], Deslippe J[1], Day N[1]
[1]*Victoria University of Wellington*

Biography:
Stacey's research looks at the microbial root associations of matagouri (Discaria toumatou), an endemic plant found in tussock grasslands. Her Masters' thesis focuses on the effect of differing levels of soil phosphorus on biomass, arbuscular mycorrhizal fungi, and actinomycetes. Stacey is based at Victoria University of Wellington and is co-supervised with Dr. Julie Deslippe.

Microbial root associations of plants can help enhance tolerance to environmental stresses and assist with nutrient acquisition. *Discaria toumatou* (matagouri) is an endemic plant found in tussock grasslands of the South Island. *D. toumatou* associates with nitrogen-fixing actinomycete bacteria (Frankia spp.) in nodules and is presumed to form root associations with arbuscular mycorrhizal (AM) fungi, although this relationship has not yet been observed. AM fungi increase phosphorus uptake to their host plants and so are an important factor for growth, especially in nutrient-poor soils. However, we know little about how *D. toumatou* growth and microbial root associations are influenced by environmental factors. Some pastoral land management strategies involve the addition of superphosphate fertilizer to low fertility soils, increasing soil phosphorus. Since *D. toumatou* fixes its own nitrogen, soil phosphorus additions may lead to increased growth under phosphorus limiting conditions. We aim to understand how soil phosphorus levels affect *D. toumatou* biomass and root biota. Our objectives are to (1) verify that *D. toumatou* forms root associations with arbuscular mycorrhizal fungi, and (2) determine whether there is a relationship between soil phosphorus content and biomass of *D. toumatou*, its colonization rate by AM fungi, and actinomycete root nodulation. We hypothesise that plants from sites with lower soil phosphorus content will have greater rates of root colonisation by arbuscular mycorrhizal fungi. Additionally, we hypothesise that a greater number and mass of actinomycete nodules will be observed in plants from high soil phosphorus sites. Empirical understanding of *D. toumatou's* response to superphosphate addition will support improved management of the species.

Brushtail Possum (*Trichosurus vulpecula*) Movements and Control in Sea Cliff Habitat, Banks Peninsula

Roberts J[1], Ross J[1], Paterson A[1]
[1]*Lincoln University*

Biography:
I am a Masters student at Lincoln University researching possum control on Banks Peninsula. While I grew up in the North Island, Canterbury has now been home for nearly six years and I am excited about every opportunity to be involved with conservation in the region. My studies have given me the chance to actively contribute to protecting a very unique part of the country, a keen interest which has spilled over into my spare time. I can be found spending as much time outdoors as possible, tramping and climbing my way around our fantastic backyard.

The considerable damage that possums (*Trichosurus vulpecula*) have inflicted on many of our native species has been well-documented, as have the methods of controlling them. However, one area that is lacking in research is their movements within and around sea cliff habitat, and how this subsequently affects other species that inhabit the area. This project is investigating the amount of time that possums are spending within the cliff faces in Nīkau Palm Gully, Banks Peninsula, before evaluating the effectiveness of combining bait stations with pest detection dogs to remove them from this habitat. A preliminary trial conducted in Le Bons Bay has shown possums to be spending time foraging and denning in the cliff faces. Now, alongside Pest Free Banks Peninsula, attention is turned to how best to control this invasive pest species in a landscape that provides significant topographical challenges. Results from the field trials (which are aiming to begin in October) will first confirm their movements as indicated by the Le Bons Bay trial, before determining what proportion of the estimated population (mark-recapture estimation method) is removed by a bait station operation. After this operation, the locating of remaining possums by pest detection dogs will show how this removal percentage can be further improved. It is the aim that the overall project will be able to indicate whether further research would be beneficial and give organisations such as Pest Free Banks Peninsula confidence that this method of control can provide the outcomes they require.

Urban Epiphyte Diversity and Conservation in Auckland

Rooke-Devoy T[1], Burns B[1]
[1]*University Of Auckland*

Biography:
Tamsin is a Masters student at the University of Auckland. Having completed a postgraduate diploma in biosecurity and conservation, Tamsin is now undertaking research on urban epiphytes. She is examining the diversity and density of epiphytes within central Auckland and aims to produce recommendations for the re-establishment of epiphytes into urban spaces.

Epiphytes are an integral part of forest systems. Often unobtrusive, they add substantially to biodiversity and ecosystem functioning. Despite these services, little research has investigated the establishment and persistence of epiphytes in New Zealand, especially in urban forest contexts. Using quantitative and experimental methods, my research aims to evaluate species richness and distribution of epiphytes in central Auckland. Using this knowledge, I will explore potential methods to conserve and augment epiphyte richness and abundance in city spaces. A quantitative survey of epiphytes will be performed in central Auckland to investigate epiphyte species richness, host preference and environments where they are present. This evidence will then be compared with mature forest epiphyte data to explore environmental and host characteristics versus epiphyte distribution. An experiment has also been set up to explore whether epiphytes (*Astelia hastata*) can be 're-established' and survive on urban hosts (*Vitex lucens*). This research will contribute knowledge that can be used to improve epiphyte presence and biodiversity in urban spaces, as well as provide insight into human-mediated dispersal and establishment. Although epiphytes often go unseen, promoting their presence in urban forests could have long-term positive impacts on ecosystem health in our cities.

Realising the Opportunities of Lawns for Urban Environmental Mitigation

Rooke-Devoy O[1], Harré N[1], Stanley M[1], Burns B[1]
[1]*University Of Auckland*

Biography:
Olivia is a PhD candidate at the University of Auckland. Building on her previous Honours research, Olivia is investigating the social and ecological characteristics of lawns through the lens of contemporary community assembly and coexistence theory. Olivia's broader research interests encompass applied urban ecology and conservation, especially from an interdisciplinary perspective.

Cities are significant contributors to pollution, loss of biodiversity and other forms of environmental degradation. This damage, to some extent, can be mitigated by the ecosystem services of urban environments. Turfgrass lawn is often overlooked for its potential to contribute to this mitigation. Advertised as an essential consumer product, managed lawn spaces are present in nearly all areas of urban nature, ranging from private domestic gardens to public parks and reserves. A nascent body of knowledge demonstrates that lawns have wide-reaching social and environmental impacts. Building on previous research conducted throughout 2018, this project will investigate ways in which resilient, biodiverse communities can be encouraged in previously homogenous lawn habitats in Auckland. The interdisciplinary nature of this research necessitates gathering evidence using a range of methods. A quantitative survey of public lawn spaces will be conducted to identify and classify lawn plant communities in relation to environment and management. Experimental 'low mow' and meadow trials have been established across Auckland to assess differing interventions across a soil fertility gradient: social surveys will be conducted in these spaces to evaluate public perceptions of this research. Overall, this knowledge may contribute to a fresh approach to the practical design and management of Auckland's lawn green spaces, with the ultimate goal of encouraging diverse ecological networks in Auckland and across New Zealand.

Acoustic call monitoring of ruru in the Southern Alps, North Canterbury

Smith G[1], Molles L[2], Curran T[1], Sullivan J[1]
[1]*Department of Pest-Management and Conservation, Lincoln University,* [2]*Atarau Sanctuary, PO Box 2341*

Biography:
Gemma is in her final year of her Bachelor of Science majoring in Conservation and Ecology at Lincoln University. Previously working in the Animal Care and Welfare Industry for 15 years, Gemma is enjoying learning new skills to start her new career in Ecology. Her focus is ranging from bats, birds, and reptiles to freshwater and restoration ecology.

The ruru (*Ninox novaeseelandiae novaeseelandiae*) is a small-sized owl commonly found throughout much of New Zealand, but it is less abundant in Canterbury and Otago. We established a monitoring programme for ruru near the Boyle River, Canterbury, New Zealand, with the objectives to: 1) compare ruru detections in beech forest vs. grassland; 2) examine the timing of ruru calls during the night; and 3) document the range of call types. Acoustic recording devices (DOC AR4), complemented by automated call recognition using the programme Kaleidoscope, were used to survey for ruru. Between three and ten recording devices were put out for four nights in beech forest in each of summer of 2020-22, while in 2022 three devices were also deployed in grassland. No ruru calls were recorded in the grassland habitat, though 25 ruru calls were reported per device per night in the beech habitat that year, indicating that in this area ruru prefer beech forest. The peak call times for ruru in beech forest were from the hours of 0000 to 0500, consistently across all years. This differs from research elsewhere that found ruru calls peaked the first hour after dusk. Kaleidoscope software identified four call types: the common 'ruru' hoot, the 'wheel', the 'wok' and the 'yelp'. All four types were heard in the beech forest over the three years of recordings, with the highest number of calls recorded in 2022. Ongoing acoustic monitoring of ruru holds great promise to reveal more of the ecology of this species.

Toitū te Whenua - Working together for the wellbeing of people and the land

Tan L[1], White T, Blanchon D, Smith H, Renata H, Toki L, Lamwilai P, Ripley D
[1]*Te Whare Wānanga o Wairaka Unitec*

Biography:
Tanya White (Ngāti Hineāmaru, Ngāti Whātua, Ngāti Maniapoto) is a kairaranga (weaver) from Aotearoa New Zealand. As a practitioner for many years her focus has been on the integration of health and wellbeing between people and the land. Tanya White's current role is at Te Whare Wānanga o Wairaka (Unitec Institute of Technology) as Kaitiaki Taiao and lecturer.

Toitū te whenua
Toitū te tangata
As the land endures, people flourish.

Uncontrolled and poorly managed urban growth and development combined with problematic patterns of hyper production and consumption pose numerous risks for the sustainability of human settlements and the environment, creating an urgent need for innovative approaches and new methodologies that weave together the intersecting viewpoints of multiple stakeholders and constituencies. In this poster, we visually document Toitū te Whenua research, a novel ongoing collaborative research project that weaves together mātauranga Māori and environmental and animal sciences to better understand, care for and protect te taiao (the natural environment).

Based at Te Noho Kotahitanga marae, Te Whare Wānanga o Wairaka Unitec, Toitū te Whenua is guided by tikanga and involves the application of kaitiakitanga, wakaritenga, ngākau māhaki and mahi kotahi. Experts in various fields come together for mini Bio Blitz events and wānanga in order to create a record of this site's species and biodiversity, improve the health of Te Wai Unuroa o Wairaka and disseminate the cultural and ecological histories of this place.

This poster presents research-in-progress, sharing aspects of this collaboration in response to the urban development taking place in and around Unitec's Wairaka campus. A key objective is to produce a report and digital knowledge repository which records and highlights the richness of biodiversity existing at Wairaka. The report is intended as a koha for the mana whenua groups of Tāmaki Makaurau and Ngāti Awa, who are the kaitiaki of the area, wāhi tapu and whenua.

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

Van Ryn S[1,2], Beggs J[1], Simpkins E[2,3]
[1]*University Of Auckland,* [2]*Auckland Botanic Gardens,* [3]*Auckland Council*

Biography:
Master of Science student at the University of Auckland. Working part time at the wonderful Auckland Botanic Gardens. Experience working in a range of fields including contaminated land, environmental policy, restoration ecology and horticulture. My passions lie in plant and animal conservation.

There is increasing global concern about the decline of invertebrate species. The widespread use of agrichemicals is likely to be a major threat to invertebrates. The global rose market was valued at €24 billion in 2008 and relies on extensive use of agrichemicals. Traditional management of roses (Rosa spp.) usually involves the use of pesticides, particularly for controlling diseases such as black spot and powdery mildew. Due to growing health and environmental concerns, spray-free regimes have been developed for many rose gardens, involving the cultivation of disease resistant rose varieties and the reduction of agrichemical inputs. The impact of pesticides on invertebrates has been studied within a variety of horticultural settings in New Zealand, but there are no studies in rose gardens. This study aims to determine the impacts of differing management regimes on invertebrate diversity in rose gardens. Invertebrate communities will be sampled using pitfall traps and litter samples in 10 Auckland rose gardens, across a gradient of pesticide use. Soil samples will also be taken to measure levels of organochlorine pesticides within surface soils as a result of historic and current pesticide usage. Endophyte communities of four rose plants from gardens with high and low spray usage will be surveyed using root tissue samples. I expect that invertebrate communities will be most diverse in rose gardens which use no or limited sprays. Knowledge of how different regimes influence invertebrate diversity will enable rose growers to select regimes that improve environmental outcomes.

Synthesis and critical analysis of rodent eradication operations carried out on the islands of New Caledonia

Weiss W[1,2,3]

[1]*French National Institute For Sustainable Development* , [2]*New caledonian Agronomic Institute,* [3]*Pacifique Doctoral School*

Biography:

Wilfried Weiss is a PhD student in ecology and population biology. His work began on June 2021 and focuses on the ecology of invasive rodents and their impact on the biodiversity of New Caledonian islands and islets. Research applied to the management and control of major invasive species. He is passionate about ornithology and has a great interest in invasive alien species.

Due to the high impact of invasive mammals, especially rodents, eradication operations are increasing worldwide, leading to increase in number of islands treated and their surface area. However, eradication failures are more frequent than elsewhere in tropical island ecosystems and New Caledonia is no exception. Synthesis and analysis of invasive rodent eradication operations can help to understand the factors of failure and success in islands of the archipelago. What can we learn from compilation and analysis of rodent eradication operations conducted on New Caledonian islands over the last 30 years? Many operations have been conducted in an uncoordinated manner by a wide variety of actors. Data are therefore currently scarce and difficult to access. Objective of this study is to provide feedback by identifying success and failure factors, methods and results of operations. Compilation of available reports and data was made and centralized in a georeferenced database with several sets of parameters describing operations. As a result, 40 operations are listed for 39 islands, 24 of which have a proven presence of rodents. A large number of actors have conducted ad-hoc operations without any scaling up of operations as elsewhere in the world. This study reveals a notable lack of consideration for biosecurity and post-eradication monitoring by operators. These observations echo the problems of lack of strategy at national level. Results of this study will help establish a methodological and scientific framework to optimize the success of future operations.

Testing drones as a tool for surveying lizards

Wills H[1], Knox C[2], Wills H[1]
[1]*University of Otago,* [2]*Southern Scales*

Biography:
Harriet Wills (Tainui) is a 3rd year ecology student at the University of Otago. She's passionate about wildlife management and conservation and is presenting results from her 2021/22 summer studentship co-funded by Te Ngaru Paewhenua and Te Papa Atawhai. Harriet's research was recently published in the journal Drones.

A lack of effective methods for sampling lizards in terrain that is inaccessible to human observers limits our knowledge of their ecology and conservation needs. Drones are increasingly being used in wildlife monitoring, but their potential use for surveying lizards has not been evaluated. We investigated: (1) the detectability of model lizards using a drone relative to a human observer, and (2) the response of four lizard species to an approaching drone in three habitat types. Model lizards placed in potential basking positions within a defined search area were detected by both the drone operator and human observer, but the probability of detection was lower with the drone. Jewelled geckos (*Naultinus gemmeus*) in shrubland and grand skinks (*Oligosoma grande*) in rocky habitats showed surprisingly little reaction to the approaching drone, enabling close approaches (means of 59 cm and 107 cm, respectively) and accurate species identification with photos taken by the drone camera. For highly patterned jewelled geckos, identification was also possible on an individual level. However, the drone was unsuccessful at detecting two alpine skink species in a near-vertical cliff habitat. Collectively, our results suggest that drones have potential as a tool for detecting small-bodied lizards in habitats inaccessible to human observers.