Early Career Researcher (ECR) Showcase

Friday 18 February 2022, online, 9am-12pm

Online symposium showcasing ECR scientific research of significance to Queensland and Queenslanders. Join us for a morning packed full of online presentations by up-and-coming scientists, followed by Q&A and panel discussion featuring RSQ senior experts and members of the Council.

This event is free and open to the public. Speakers and audience members must register here to obtain Zoom link to access the event on the day.

INFORMATION FOR AUDIENCE MEMBERS

Please keep your Zoom audio muted to minimise background noise during presentations and discussions. Please also keep your video switched off unless you’re presenting or participating in a discussion. This will reduce bandwidth usage so that we experience as little technical difficulties as possible on the day. You are free to join and leave the Zoom event as you wish. If you miss any of the Q&A/discussion components of the event, you can type your comment(s) in the Zoom chat function directed to all or specific participants. If you wish to ask a question or interact with the speakers, please click on the ‘raise your hand’ icon so that the session Chair can manage questions.

INFORMATION FOR SPEAKERS

Please aim to present for a total of 7 minutes leaving 3 minutes for Q&A/brief panel feedback. The program is open to the public and features a range of topics, so we want to avoid long and complex presentations. Instead, please focus on the novelty of your science and the significance or your research to the wider Queensland community. We ask that you balance your presentation style and content so that they address an audience versed in the sciences generally, but not specifically in the technicalities of your topic or method.

If you’re not planning to attend the entire event, please log on at least 5 minutes before your scheduled presentation. You will be made a co-host for the duration of your presentation so that you can share your slides using the Zoom share screen function. You are free to send a copy of your PPT slides by 17 February 5pm to Dr Justyna Miszkiewicz editor@royalsocietyqld.org.au. We will share the slides for you should any technical issues arise with screen sharing on your end on the day.

The event will be recorded and uploaded onto YouTube at a later date. Please let Dr Justyna Miszkiewicz know if you’d rather your presentation not be recorded/shared online.

Please direct any other queries to:

Vice President, Policy Dr Geoff Edwards vice-president-cp@royalsocietyqld.org

Event Chair, Dr Justyna Miszkiewicz editor@royalsocietyqld.org.au

Event website: https://www.royalsocietyqld.org/news-events/all-events/showcasing-early-career-researchers/
We want the event to be delivered in a friendly, supportive, and respectful environment. We ask that feedback given to ECRs is constructive.

SCHEDULE

All times are shown in AEST (Queensland). Presenter names are in bold.

9.00-9.10am
Welcome to Country by Bridgette Chilli Davis, Murulla Kabi Kabi First Peoples woman
Welcome from President, Housekeeping

SESSION 1

9.10–9.20 am
Boomerangs shape stone tools in ancient Queensland: Experimental archaeology and Traditional knowledge reveal a new function of the most iconic Indigenous tool
Eva Francesca Martellotta, Paul Craft

9.20–9.30 am
The effect of coral bleaching impacts on the recreational value derived from the Great Barrier Reef
Henry A. Bartelet, Michele L. Barnes, Kim C. Zoeller, Graeme S. Cumming

9.30-9.40am
Testing strontium for estimating weaning ages: Implications for marsupial life history reconstruction
Maya Bharatiya, Tanya M. Smith, Christine M. Austin

9.40-9.50am
Tidal restriction leads to enhanced methane emissions in tropical Australia
Charles Cadier, Scott Fry, Nathan Waltham, Adam Canning, Maria Fernanda Adame

9.50–10.00am
The potential effect of intersex individuals on threatened bird populations
Clancy Hall, Dr Dominique Potvin, Dr Gabriel Conroy, Dr Martina Jelocnik, Vasilli Kasimov

10.00-10.10am
‘Invasion debt’ after extensive land-use change: An example from central Queensland
Gabrielle Lebbink, Rod Fensham, John Dwyer

10.10-10.20am
Optimising facility location and sizing for coral aquaculture production
Ryu B. Lippmann, Kate J. Helmstedt, Mark T. Gibbs, Paul Corry

10.20–10.30am
Identification of novel peptides in Cavendish banana during fusarium wilt infection
Alexandria Mattinson, Ryan Zujic, Shi Wei Chen, April Hastwell, Elizabeth Aitken, Brett Ferguson

10.30-10.40am BREAK
SESSION 2

10.40-10.50am
*Transcriptomic analysis of tissue regeneration in the Australian Redclaw crayfish identifies stem cell markers and myogenic differentiation genes: potential tools to develop cultured crustacean meat*
Lisa Musgrove, Susan Glendinning, Josephine Nocillado, Cameron Hyde, Tomer Ventura

10.50-11.00am
*Using DNA information to breed for disease resistant strawberries*
Katie O’Connor, Jodi Neal, Apollo Gomez, Joanne De Faveri

11.00-11.10am
*“Cyclone Babies”: Maternal accounts of pregnancy during severe cyclone events in Queensland*
Cynthia Parayiwa, Amelia Kennedy, Alison Behie

11.10-11.20am
*Habitat use and survivorship of the endangered northern bettong post-fire*
Christopher A. Pocknee, Jane A. McDonald, Diana O. Fisher

11.20-11.30am
*Are tropical mountaintop trees constrained in their distributions by physiological limitations: Thermal adaptation and acclimation to climate change*
Arun Singh Ramesh, Alexander W. Cheesman, Darren M. Crayn, Lucas A. Cernusak

11.30–11.40am
*Wolbachia in scale insects: A unique pattern of infection prevalence, high genetic diversity, and host shifts*
Ehsan Sanaei

11.40–11.50am
*What can ancient DNA bring to the identification of fallen Australian war casualties? Pioneering methodologies at Queensland based Ancient DNA Facilities*
Sally Wasef, Ido Bar, Natasha Mitchell, Kirsty Wright

11.50-12pm CONCLUSIONS AND EVENT CLOSES
ABSTRACTS

The effect of coral bleaching impacts on the recreational value derived from the Great Barrier Reef

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Feedbacks between people and ecosystems are central to the study of Social-Ecological Systems (SES) but remain poorly understood. It is commonly assumed that changes in ecosystems leading to a reduction in ecosystem services will trigger human responses that seek to restore service provision. Other responses are possible, however, but remain less-studied. In this paper we empirically tested the impact of climate-induced ecosystem change on the demand for and satisfaction with recreation on coral reefs in the Great Barrier Reef (GBR) region of Australia. We used TripAdvisor data as proxy for visitor numbers and satisfaction ratings. Our final dataset included a total of 41 reef tourism operators and some 48,000 customer reviews from the years 2008-2021. Our findings emphasise the importance of human culture and perception as influences on human responses to environmental change, and the relevance of the more subjective elements of social systems for understanding social-ecological feedbacks.

Testing strontium for estimating weaning ages: Implications for marsupial life history reconstruction

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Documenting the transition from infant nursing to an adult diet can shed light on the reproductive strategies of mammals, including the enigmatic Diprotodon and other megafauna that once roamed Queensland. Concentrations of the trace element strontium in primate teeth have been used as a proxy to estimate this transition. An influential model posits that strontium levels (relative to calcium) should be low during initial nursing due to limited strontium in milk, increase with the introduction of solid foods that contain higher amounts of strontium, peak at the cessation of suckling, and slowly decline as the gut begins discriminating against strontium in favor of calcium. This study tests this model by assessing trace elements in 13 human and non-human primate first molars (M1) with laser ablation-inductively coupled plasma mass spectrometry. Only 54% of M1s had a peak in strontium immediately after the cessation of suckling, and none of these showed a subsequent decline in strontium. Alternative approaches are needed for inferring the weaning ages and life histories of ancient marsupials.
Tidal restriction leads to enhanced methane emissions in tropical Australia

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In Queensland, tidal restriction of coastal wetlands alters their hydrological connection and creates freshwater impounded wetlands, increasing methane emissions. We investigated greenhouse gas emissions from tidally restricted wetlands and compared it with adjacent tidally connected wetlands (saltmarsh and mangroves). Furthermore, we investigated the influence of seasons and soil physicochemical parameters on greenhouse gas emissions. Tidal restriction leads to significantly higher methane emissions compared to natural coastal wetlands. Soil redox, carbon density, nitrogen density, moisture and density were all significantly correlated to methane emissions. Seasons influenced greenhouse gas emissions, with higher emissions in summer. Overall, tidally restricted wetlands were emitting 2175 mg CO\textsubscript{2}-eq.m\textsuperscript{-2}.d\textsuperscript{-1}, two orders of magnitude higher than tidally connected wetlands which emitted 18 mg CO\textsubscript{2}-eq.m\textsuperscript{-2}.d\textsuperscript{-1}. This research is supporting tidal restoration in Queensland as a cost-effective strategy to mitigate climate change as it has the potential to enhance blue carbon burial rates and avoids long term emissions of methane.

The potential effect of intersex individuals on threatened bird populations

Clancy Hall\textsuperscript{1*}, Dominique Potvin\textsuperscript{2}, Gabriel Conroy\textsuperscript{3}, Martina Jelocnik\textsuperscript{1}, Vasilli Kasimov\textsuperscript{3}

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Recent research into avian reproductive biology has revealed that sex determination in birds is more fluid than previously thought. Stress hormones or endocrine-disrupting substances in the female’s environment immediately prior to egg formation, may be transferred into the egg and trigger a phenotypic sex reversal. Resulting offspring are of concern to threatened populations as they are often reproductively redundant.

I will discuss the findings of a South-east Queensland study on the prevalence of intersex in five locally common species. Over 450 specimens were processed from wildlife hospitals in Brisbane, the Gold Coast and Sunshine Coast. Morphological measurements and photographs were taken of external features and of the gonads and a liver sample was taken for genetic sex determination. All data was compared to identify individuals with a discordance between their genetic and phenotypic sex.

If threatened species are placed under increasing stress and endocrine disrupting substances cumulate in the environment, it is evident from other taxa that so too does the incidence of intersex. This study aims to act as an important time stamp of intersex prevalence and to inform threatened species managers of the potential effects they may be having on critical populations.
Land-use change and associated land clearing and habitat fragmentation can facilitate the spread of invasive plant species. Queensland has been subject to rapid and extensive land clearing and conversion for several decades. Between 1997 and 2017, we examined land-use change and the spread of three prominent invaders; buffel grass (*Cenchrus ciliaris*), Indian couch (*Bothriochloa pertusa*) and parthenium weed (*Parthenium hysterophorus*), within a 130,950 km$^2$ focal area of central Queensland. This time-period captures both the end of a historic era of intense land clearing and the beginning of policies aimed at reducing land clearing. Prior to 1997, 45% of the area had been cleared. Between 1997 and 2017, 7392 km$^2$ was cleared and this was often in areas protected under federal policy. We also found a significant increase in the cover and occupancy of Indian couch and buffel grass and suggest the spread of these invaders is likely a consequence of ‘invasion debt’ incurred from an intense history of land use change and degradation in the region.

**Optimising facility location and sizing for coral aquaculture production**

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Active restoration is increasingly being seen as a viable method for reversing global coral reef decline in many locations. We assess coral aquaculture production as a restoration strategy to grow and deploy cultivated corals to specified reef locations in the wild. We formulate and solve a novel mathematical programming model of the facility location and sizing problem for coral aquaculture. This is used to address crucial strategic decisions regarding the number, location, and sizing of facilities, as well as operational decisions of residence time to minimise total costs. The characteristic function for coral survival based on facility residence time is shown to be critical in determining the optimal residence time. Computational experiments demonstrate that the optimal number and location of facilities are sensitive to changes in the reefs serviced and the relative weighting of capital and operational cost parameters. This demonstrates the value of data clarity to minimise total costs.
Boomerangs shape stone tools in ancient Queensland: Experimental archaeology and Traditional knowledge reveal a new function of the most iconic Indigenous tool

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Without a doubt, boomerangs are one of the Sunshine State symbols. But forget everything you know about their 'returning effect'. Whereas returning boomerangs were only used for games and learning purposes, non-returning boomerangs were complex, multifunctional tools. They played a crucial role in Aboriginal communities' daily lives in Queensland and other parts of Australia.

In our work, we put together Traditional knowledge and experimental archaeology to investigate a forgotten use of boomerangs: modifying the edges of stone tools. This activity is fundamental to producing a variety of stone implements, each of them with a specific function. In our study, experimental replicas of boomerangs proved very functional to shape stone tools. Our results are the first scientific proof of the multipurpose nature of these iconic objects.

Identification of novel peptides in Cavendish banana during fusarium wilt infection

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Queensland produces 94% of Cavendish bananas in Australia, an industry worth $596m¹. However, Cavendish bananas are under threat of an aggressive fungal disease called Fusarium wilt. The aggressive hemibiotrophic fungus survives in soil and can completely decimate plantations with devastating financial impacts. There are no known chemical or biological treatments for the disease, and therefore research to understand the pathogenicity of Fusarium wilt is crucial. One potential mechanism that leads to infection could be through peptide signalling. Therefore, it is important to identify potential resistance peptide signals in banana. The CLAVATA3-ESR-related (CLE) peptide family will be investigated in this regard as they are involved in a variety of plant regulatory processes, but many remain uncharacterised. This will help to understand the molecular signalling of these peptides and the potential role they might play during infection. This research is a step towards relieving the stress of impending crop extinction for Queensland banana farmers.

Transcriptomic analysis of tissue regeneration in the Australian Redclaw crayfish identifies stem cell markers and myogenic differentiation genes: potential tools to develop cultured crustacean meat

Lisa Musgrove\textsuperscript{1,2*}, Susan Glendinning\textsuperscript{1,2}, Josephine Nocillado\textsuperscript{1,2}, Cameron Hyde\textsuperscript{1,3}, Tomer Ventura\textsuperscript{1,2}

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Cultured meat is an emerging technology aiming to produce real meat tissues from animal stem cells rather than live animals, thus alleviating many problems attributed to livestock farming. Crustacean foods are no exception with issues such as pollution, overfishing, animal welfare concerns, disease outbreaks and the threat of a warming climate increasingly impacting current production models. Growing crustacean stem cells into meat is challenging because there are no available cell lines, robust cell culture protocols, or deep understanding of the molecular drivers of growth and muscle development. Our transcriptomic analyses of regenerating tissues in a Queensland crayfish have uncovered genes related to stem cell proliferation and myogenic differentiation. We will now utilise these in cell cultures and attempt to encourage myogenesis through transfection experiments to grow crayfish meat in vitro. This technology presents an additional, more sustainable supply of crustacean products for Queensland, while also advancing our local manufacturing industry.

Using DNA information to breed for disease resistant strawberries

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Strawberries are susceptible to many diseases that cause damage to leaves and fruit, such as powdery mildew. Many chemical sprays are used to control disease, but there is an industry, environmental and societal push to move away from fungicides. Breeding for disease-resistant varieties offers an alternative approach, and DNA information can be used in this strategy. We identified multiple genetic markers linked with resistance to powdery mildew in leaves and fruit using a statistical modelling method called genome-wide association studies. We also used DNA information across the entire genome to predict the susceptibility of different strawberry varieties. These results will help Queensland strawberry breeders to identify candidate varieties that are resistant to powdery mildew without expensive and time-consuming disease screening trials. These statistical methods can also be applied to other diseases, as well as yield and fruit quality traits.
“Cyclone Babies”: Maternal Accounts of Pregnancy During Severe Cyclone Events in Queensland

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Climate change is increasing the frequency and intensity of tropical cyclones. Prenatal stress during an extreme weather event can negatively impact maternal mental health and birth outcomes. The aim of this study was to explore the experiences of women pregnant during cyclones in Queensland, Australia. Mothers completed an online questionnaire and volunteered to participate in semi-structured interviews conducted from June to July 2020. Twelve women were interviewed, and transcripts were examined using thematic analysis. We present preliminary findings on their experiences and how they contributed to their perceived stress. Although interviewed mothers identified multiple areas as amplifying their levels of perceived stress, they also shared areas that contributed to increasing resilience originating primarily from past experiences and their support networks. Our study provides qualitative insight into what individual factors can increase or decrease vulnerability in this priority group. Findings will further inform future research and ongoing disaster risk management strategies.

Habitat use and survivorship of the endangered northern bettong post-fire

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The impacts of changed fire regimes on Australia’s mammals are increasingly being recognised. The northern bettong (Bettongia tropica) is one example of an endangered mammal that is thought to have declined due, at least in part, to changed fire regimes in recent times that have allowed fire-intolerant species to encroach on the bettong’s preferred habitat. We deployed 20 GPS collars on northern bettongs before fire over two field seasons to obtain data on bettong home range and nesting areas before and after fire. Bettong home range size, nesting area, density and population health parameters were assessed. Our results suggest that bettong’s overall home range does not shift following low-to-medium intensity fire, likely due to their food sources’ resistance to fire, but they will shift their nesting areas to unburned grassy patches. This supports the belief that northern bettongs are well-adapted to low intensity fires.
Are tropical mountaintop trees constrained in their distributions by physiological limitations: thermal adaptation and acclimation to climate change

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Habitat suitability for most tree species restricted to the wet tropical mountaintops of Australia is predicted to decline with climate change. This is especially concerning because no available alternative habitat exists for species to migrate, and their growth responses to warming are understudied. We present a study investigating the effects of warming on an ecologically important taxon, \textit{Flindersia} spp. – distributed across elevation gradients in the Australian Wet Tropics. We test, a) whether tropical mountaintop tree species are constrained in their distributions by physiological limitations to thermal environment; and b) whether species display an ability to adapt and/or acclimate to future warming. We first explored trends in species’ in-situ adaptation by studying leaf traits among congeners paired with environmental variables, and then evaluated plant physiological and growth responses under experimental soil nutrients and growth temperatures. We present key research findings and highlight its implications on conservation of species in these fragile ecosystems.

Wolbachia in scale insects: A unique pattern of infection prevalence, high genetic diversity, and host shifts

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Wolbachia is one of the most successful endosymbiotic bacteria of arthropods. It is a master manipulator, modifying its hosts’ biology in many ways to increase its vertical (maternal) transmission. Wolbachia can also undergo host shifts that can be mediated by ecological vectors such as shared host plants or parasitoids. By conducting Illumina pooled amplicon sequencing of 59 infected scale insect samples mostly collected in Queensland and 16 direct associates of scale insects (including wasps and ants), I determined 63 Wolbachia strains in these species belonging to supergroups A, B and F. Finally, I fitted a Generalised Additive Mixed Model (GAMM) to assess factors influencing Wolbachia sharing among scale insect species. I found strong effects of host phylogeny without any significant contribution of host geography. This is the first study uncovering Wolbachia diversity in Queensland, improving our understanding of its ecological dynamic among the insect's community and providing powerful tools to evaluate factors influencing microbial host shifts.
What can ancient DNA bring to the identification of fallen Australian war casualties? Pioneering methodologies at a Queensland based Ancient DNA Facilities.

Sally Wasef1,2*, Ido Bar3, Natasha Mitchell4, Kirsty Wright4

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A fundamental problem in the identification of recovered Australian remains is that the current approach relies on forensic DNA methods developed for modern criminal casework, which are not suitable for degraded DNA. At the ARCHE Ancient DNA Facility, we have been conducting pilot research involving DNA from the remains of a WWI Australian soldier recovered from Belgium. We have shown that advancements in extraction, next-generation sequencing, and bioinformatics of ancient DNA provided a more informative approach for identifying fallen soldiers than traditional forensic methods alone. We successfully retrieved whole-genome data, revealed the maternal (mtDNA) and parental (Ych) haplotypes, and some phenotypic characteristics that can be used to target identification efforts. This pilot study highlights methodological advancements and the importance of genealogical searches of living relatives and their DNA to identify recovered remains and bring closure to their loved ones. Our methods have implications for future aDNA recovery efforts at QUT and across Queensland.