68th Annual Scientific Meeting of the Australian Mammal Society 2022

Conference Program

AWST	Tuesday 27th September	
12:30–13:30	Students and ECRs Workshop 1: Navigating Publishing	WA Museum Boola Bardip - Woodside Learning Studios Perth Cultural Centre, Perth WA 6000, Australia
14:30–15:15	Workshop 2: Early Career Researcher 'Speed dating'	
12:30–16:00	Pre-Conference Tour: WA Museum collection	WA Museum Collection and Research Centre Pick up and return by bus from Double Tree Northbridge
17:00	Conference registration and welcome drinks mixer	Wildlife Gallery, WA Museum Boola Bardip, Northbridge Perth

Conference venue: DoubleTree by Hilton Perth Northbridge,
100 James St, Northbridge WA 6003

AWST	Wednesday 28th September			DoubleTree by Hilton Perth Northbridge
8:45	CHAIR: Kenny Travouillon		Kenny Travouillon	Conference welcome and Welcome to Country
9:15		1	**Plenary 1:** Larissa Potter, Azarnia Malay, Amelia Hurrell, Dambimangari Rangers	Working in partnership for conservation in the Kimberley
10:00		2	Kate Dutton-Regester	Reproductive behaviour of captive short-beaked echidnas: a focus on quantifiable changes before and after oestrus and oviposition
10:15		3	Jack Bilby ☺	Not so vulnerable? High juvenile survival and changes in shelter use in a reintroduced population of western quolls
10:30	**Morning Tea**			
11:00	CHAIR: David Taggart	4	Christine Cooper	What does surface temperature tell us about the heat balance of free-living numbats?
11:15		5	Caitlin Mudge	Mitochondrial DNA supports extinction of a western quoll subspecies (*Dasyurus geoffroii geoffroii*) following European arrival
11:30		6	Amy Edwards	8,820 Pitfall trap nights: A preliminary analysis
11:45		7	Emily Scicluna ☺	Fat-tailed dunnarts of the Victorian grasslands: vulnerable to extinction
12:00		8	Serina McConnell	Genomic review of natural and translocated numbat (*Myrmecobius fasciatus*) populations
12:15		9	Tony Friend	The 'Boullanger Island' dunnart *Sminthopsis fuliginosus*: a feisty little battler hangs on!
12:20		10	Mike Calver	Murdoch University sponsored talk
12:25		11	Kenny Travouillon	WA Museum sponsored talk
12:30	**Lunch**			

AWST	Wednesday 28th September			DoubleTree by Hilton Perth Northbridge
13:30	CHAIR: Amy Edwards	12	Jake Newman-Martin ☺	Using subfossils to reassess the taxonomy of mulgaras
13:45		13	Tim Henderson ☺	Density estimates reveal that fragmented landscapes provide important habitat for conserving an endangered mesopredator, the spotted-tailed quoll
14:00		14	Brenton von Takach	Population genomics and conservation management of rodents and quolls in northern Australia
14:15		15	Kelly Rayner	Dibbler dormitories: improving post translocation monitoring success of a small dasyurid using soft release techniques
14:30		16	Linette Umbrello	Small wonders: two new species of tiny marsupials
14:35		17	Melissa Taylor	Pattern recognition software to identify uniquely marked individuals
14:40		18	Mitchell Cowan	The secret life of northern quolls: revealing the impact of mining disturbance on this threatened carnivore
14:45		19	Erin Mein	differentiating rare bandicoots in a late quaternary cave deposit
15:00	**Afternoon Tea**			
	Please take note of our posters	1	Mike Calver	*Australian Mammalogy* and other CSIRO publishing journals
		2	Tiana Ceissman	Presentation of Babesiosis in eastern grey kangaroo joeys (*Macropus giganteus*)
		3	Rhiannon de Visser	Population genetics of wild red-tailed phascogales in south-west Western Australia
		4	Emma Johnston	Morphological and genetic differentiation between populations of rufous hare-wallaby (*Lagorchestes hirsutus*)
		5	Eleanor Pease	What did the marsupial tapir eat? Reconstructing the palaeobiology of *Palorchestes parvus*, a bizarre extinct giant from southeast Queensland
		6	Louise Seddon	Genetic diversity assessment of the silver-headed antechinus
		7	Rachyl-anne Stover	eDNA reveals the diets of cryptic, threatened mammals on an island translocation
		8	Christopher Urbanek	Landscape Genetics of eastern grey kangaroos; defining resistance as a tool for effective conservation management
		9	Hayley Winter	The genetic and morphological variation within *Sminthopsis virginiae* (red-cheeked dunnart)
		10	Michael Wysong	On-ground recovery actions for south coast threatened mammals

AWST	Wednesday 28th September			DoubleTree by Hilton Perth Northbridge
15:30	CHAIR: Brenton von Takach	20	Cassandra Arkinstall ☺	The benefits of using passive and intensive monitoring methods for a reintroduced greater bilby population
15:45		21	Joanna Lyall	Testing recovery measures for the threatened eastern barred bandicoot in Tasmania
16:00		22	Kenny Travouillon	New species of bandicoot in the genus *Peroryctes* (marsupialia: Peramelemorphia) from Kwiyawagi, Irian Jaya, Indonesia
16:15		23	Tom Mansfield ☺	A plant pathogen reduces the habitat and foraging activities of quenda
16:30		24	Bridgette Barnden	Measuring the naivety of eastern barred bandicoots towards cats at various stages of the predation sequence
16:35		25	Rex Mitchell	Kangaroos outside the dingo barrier fence grow faster than those inside
16:40		26	Shelby Middleton	Taxonomy and evolution of the common brushtail possum *Trichosurus vulpecula* in Australia
16:45		27	Yaara Aharon-Rotman	Flexible torpor in squirrel glider: an adaptation to unpredictable climate?
17:00		28	Toby Maidment ☺	Dysbiotic pouch microbiome associated with poor developmental outcomes in captive breeding koalas (*Phascolarctos cinereus*)
17:15		29	Natasha Tay ☺	Predator escape behaviour in threatened marsupials
18:00	**Student Dinner**			**Lucky Chan's, 311 William St, Northbridge WA 6003**
18:00	**Old Farts dinner**			**TBA**

AWST	Thursday 29th September			DoubleTree by Hilton Perth Northbridge
8:45	CHAIR: Christine Cooper	30	Plenary 2: Kevin Rowe	Museum collections and contemporary Australian mammalogy
9:30		31	Matthew Lott	Future-proofing the koala: synergising genomic and environmental data for effective species management
9:45		32	Shannon Kleemann ☺	Non-invasive monitoring and reintroduction biology of the brush-tailed rock-wallaby (*Petrogale penicillata*) in the Grampians National Park, Australia
10:00		33	David Taggart	Distribution, abundance and disease status of southern hairy-nosed wombats in adjacent areas of cropping and native vegetation on the Southern Yorke Peninsula, South Australia
10:15		34	Natasha Harrison ☺	Preliminary evidence for the loss of anti-predator responses from a havened mammal population
10:30	**Morning Tea**			
11:00	CHAIR: Tamara Keeley	35	Sophia Callander	Tricky Stickies: monitoring hard to detect mammals in nests and trees
11:15		36	Bertram Ostendorf	Biases in estimates of animal abundance. Using the southern hairy-nosed wombat (*Lasiorhinus latifrons*) as a model species
11:30		37	Gilbert Price	New fossils reveal giant short-faced kangaroos (Sthenurinae; Macropodidae) ranged across the Australian tropics in the late Pleistocene
11:45		38	Jade Seaton ☺	Faecal analysis for a better future: progesterone metabolite monitoring as a management tool for breeding koalas in captivity
12:00		39	Ebony James	Taxonomic investigation of greater gliders (*Petauroides volans*) using 3D geometric and linear skull morphometrics
12:15		40	Nathan Waddell	Assessing the use of chainsaw hollows by wildlife across fire-affected East Gippsland, Victoria
12:20		41	Lesley Gibson	DBCA sponsored talk
12:25		42	Rob Davis	Edith Cowan University sponsored talk

AWST	Thursday 29th September			DoubleTree by Hilton Perth Northbridge
12:30	**Lunch**			
13:30	CHAIR: Matthew Lott	43	Sara Corsetti	How do personality, rehabilitation protocol and release methods affect survival in rehabilitated western ringtail possums – preliminary results
13:45		44	Murraya Lane ☺	The effects of bushfire and rehabilitation on home ranges and movements of koalas
14:00		45	Joshua Hungerford	Management of an isolated population of a threatened macropod: Black-flanked rock-wallabies in the Avon Valley
14:15		46	Lauren Werner	Population characteristics and genetic health of the semi-arid adapted yellow-footed rock-wallaby (*Petrogale xanthopus xanthopus*) at Aroona Dam Sanctuary, 23 years after reintroduction
14:30		47	Sean Buckley	Population recovery and genetic rescue of black-flanked rock wallabies (*Petrogale lateralis lateralis*) in the Western Australian wheatbelt
14:45		48	Tamara Keeley	Validation of faecal glucocorticoid metabolite analysis in koalas as a conservation physiology tool
15:00	**Afternoon Tea**			
15:30	CHAIR: Trish Fleming	49	Chloe Frick	The survival and recruitment of reintroduced brush-tailed bettongs (*Bettongia penicillata*) 12 months in a predator supressed landscape.
15:45		50	Stacey Dix ☺	Tammar time capsule: population genetics of tammar wallabies reintroduced to the Southern Yorke Peninsula, SA, 18 years since their return to the mainland
16:00		51	Eduardo Maher	Cross-cultural collaboration leads to improved understanding of the rare spectacled hare-wallaby in the west Kimberley
16:15		52	Kate Rick ☺	The relative role of drift and selection in shaping morphological divergence in a threatened bettong
16:30	**AMS AGM**			**DoubleTree by Hilton Perth Northbridge**
19:00	**Conference dinner**			**Fraser's Restaurant Kings Park, 60 Fraser Ave, West Perth WA 6005**

AWST	Friday 30th September			DoubleTree by Hilton Perth Northbridge
8:45	CHAIR: Renee Catullo	53	Plenary 3: Rebecca McIntosh	Seals as ecosystem sentinels: a multidisciplinary approach
9:30		54	Claire Tingate	Arboreal mammal distribution, abundance and diversity in roadsides of the Strathbogie Ranges, Victoria
9:45		55	Cath Kemper	Strandings in St Vincent Gulf bioregion, South Australia: 12-year study provides benchmark for monitoring biology and pathology of cetaceans in Australia
10:00		56	Delphine Chabanne	Evidence of male alliance formation in a small dolphin community
10:15		57	Nahiid Stephens	Pathology and ecology of 'fresh water skin disease': an emerging climate-driven threat to coastal resident dolphins in Australia
10:30	**Morning Tea**			

AWST	Friday 30th September			DoubleTree by Hilton Perth Northbridge
11:00	CHAIR: Delphine Chabanne	58	Renee Catullo	Translating conservation genetics: lessons learned from the 2019-20 bushfires
11:15		59	Bryony Palmer	Shark Bay mice on Faure Island use a range of different habitat types
11:30		60	Ione Arbilla	Climatic, environmental, and biological factors influence European rabbit invasion hot spots in the Nullarbor region
11:45		61	Rebecca Quah	Conservation genetics and population modelling using high performance computing: the reintroduction of *Pseudomys gouldii*
12:00		62	Misha Rowell	Problem solving in wild animals in the wet tropics of Queensland
12:15		63	Vikram Vakil ☺	The vulnerability of the hopping mouse (*Notomys*) of Australia: integrating data from palaeontology with modern conservation
12:30	**Lunch**			
13:30	CHAIR: Adrian Wayne	64	Terry Coates	A "leaky boat" strategy for fox management in a peri- urban reserve
13:45		65	Peter Fleming	How to kill foxes: does aerial baiting control foxes in mesic environments?
14:00		66	Tracey Kreplins	Dingo DNA: what can we use it for?
14:15		67	Mark Garkaklis	Forest fire management, control charts and the protection of threatened small mammal populations in southwestern Victoria
14:30		68	Natalie Grassi ☺	Diet of the invasive red fox in the Pilbara, Western Australia, with a focus on native species predation
14:45		69	Tenaya Duncan ☺	The curious cat: interactions and visitation rates by feral cats at artificial refuges
15:00	**Afternoon Tea**			
15:30	CHAIR: Natalie Warburton	70	Bronte Van Helden	Conservation in the city: the importance of residential gardens for mammal wildlife
15:45		71	Barbara Wilson	Refuges for conserving threatened small mammals in the Otway Ranges
16:00		72	Adrian Wayne	Felixer grooming trap trial: Feral cat control for conservation in the southern forests, Western Australia
16:15		73	Hannah Bannister	Feral predators and stochastic events: influences on ngwayir activity towards the edge of their range
16:30		74	Trish Fleming	Food fight? Dietary overlap in Australian eutherian predators
16:45		75	Robyn Shaw	Rodents, marsupials and bats – oh my! Community composition in a mammal hotspot
17:00	**Student Awards**			
18:00–22:00	**Post-conference tour 1** Karakamia Sanctuary – Spotlighting tour			Pick up and drop off from Double Tree Northbridge

AWST	Saturday 1 October	
9:00–15:00	**Post-conference tour 2** Paruna Sanctuary – self-guided walking tour	Pick up and drop off from Double Tree Northbridge

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Department of **Biodiversity, Conservation and Attractions**

The Department of Biodiversity, Conservation and Attractions (DBCA) works to conserve Western Australia's world-renowned biological diversity, including its native fauna. It does this based on world-recognised science to build and share biodiversity knowledge to support evidence-based management; collating, managing and sharing data to support effective decision making and conservation; developing adaptive management tools to promote ecosystem resilience to the impacts of climate change and other threats; managing threats from introduced predators including foxes and feral cats through the Western Shield program; protecting habitats from plant disease, weeds and pest animals; and managing a system of comprehensive, adequate and representative conservation reserves throughout Western to contribute to long-term conservation of biodiversity and the culture and heritage of Aboriginal people.

As a science-based organisation, DBCA maintains scientific expertise and biodiversity knowledge and uses this knowledge to support the functions of the department's Parks and Wildlife Service, Botanic Gardens and Parks Authority, Zoological Parks Authority and Rottnest Island Authority. DBCA science staff have expertise in animal biology, animal breeding, aquatic and terrestrial ecology, biological survey, collections management, conservation biotechnology, conservation genetics, conservation medicine, conservation policy, data science, ecological restoration, ecoinformatics, ecophysiology, fire behaviour, hydrology, marine biology, plant biology, remote sensing, seed biology, social science, structured decision making, spatial analysis, systematics and taxonomy. This breadth of scientific and research expertise provides a sound evidence base for effective decision making and enables long-term monitoring of conservation activities within WA's network of terrestrial and marine parks and reserves.

DBCA works in partnership with research organisations, Traditional Owners, private companies, Australian Government agencies, community groups and non-government organisations to develop and implement programs to conserve and improve the management of the State's biodiversity, based on best-practice science.

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The Western Australian Museum's long and fascinating history reflects and documents the State's rich and diverse natural and cultural heritage.

Established in 1891 in the old Perth gaol, it was known as the Geological Museum and its collections were geological, ethnological and biological. In 1897 it officially became the Western Australian Museum and Art Gallery.

During 1959 the botanical collection was transferred to the new Herbarium and the Museum and the Art Gallery became separate institutions. The Museum focused its collecting and research interests in the areas of natural sciences, anthropology, archaeology and the State's history. Over the 1960s and 1970s it also began to work in the emerging areas of historic shipwrecks and Aboriginal site management.

Today the Western Australian Museum comprises six public sites and a collection and research centre and houses more than 8 million objects from rare fossils to the iconic racing yacht Australia II.

The Museum also manages 200 shipwreck sites of the 1500 known to be located off the WA coast and manages eight Aboriginal land reserves.


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There is a very strong research culture in wildlife biology, ecology and biosecurity at Murdoch University, which supports undergraduate courses and postgraduate degrees in Conservation & Wildlife Biology, Biological Sciences, Environmental Science, and Biosecurity. The Harry Butler Institute (HBI) at Murdoch University champions a research space where community, business and biodiversity can co-exist, directing conservation research towards landscapes where some of the greatest challenges for sustainability and biodiversity conservation are encountered. The Institute captures translational research delivered across four research centres: Terrestrial Ecosystems Science and Sustainability; Sustainable Aquatic Ecosystems; Water, Energy & Waste; and Biosecurity and One Health. High quality outcomes are achieved through global collaborations and interweaving appropriate novel technology themes to improve efficiencies and scale.

https://www.murdoch.edu.au/research/hbi
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The School of Science at Edith Cowan University offers a diverse and exciting range of courses including the areas of conservation biology and environmental science. We are active in mammal research and wildlife biology, and our courses are developed in consultation with industry and informed by a dynamic research program.

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PLENARY SPEAKERS

PLENARY

WORKING IN PARTNERSHIP FOR CONSERVATION IN THE KIMBERLEY

Malay, Azarnia[1], Hurrell, Amelia[1] & **Potter, Larissa[2]**

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[2]Australian Wildlife Conservancy, 21 Hopton Street, Broome, Western Australia, 6725

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Indigenous managed lands and protected areas are crucial for the conservation of Australia's unique biodiversity. Nowhere is this more apparent than Western Australia's remote Kimberley, a region of international conservation significance, and a region where 93% of the area falls under Native Title lands. *The Dambimangari Native Title claim was determined in 2011, and from this Dambimangari declared an Indigenous Protected Area (IPA), developed a ten year Healthy Country Plan and strategic partnerships to support conservation efforts.* In 2018, Dambimangari Aboriginal Corporation, representing the Dambimangari People, and Australian Wildlife Conservancy developed an innovative partnership across 800,000 hectares of Dambimangari Native Title area, building on an existing relationship working together across 568,000 hectares at Yampi Sound Training Area with the Department of Defence, also the traditional lands of the Dambimangari People. Dambimangari Country is special - rich in culture and a hotspot for threatened and endemic mammal species. The partnership aims to provide measurable conservation outcomes and socio-economic benefits for the Dambimangari People. This is achieved through combining thousands of years of traditional knowledge with western science and evidence-based conservation land management. Under the partnership, Dambimangari Aboriginal Corporation and Australian Wildlife Conservancy have been working together to conduct biodiversity surveys, as well as weed, feral animal and fire management, and capacity building and skills training. This work supports the goals of Dambimangari's Healthy Country Plan and Australian Wildlife Conservancy's mission.

Dambimangari Rangers

The Dambimangari Rangers manage our Traditional land, sea and islands in the remote North-West Kimberley Region. The name for our people comes from Dambima, meaning “homelands”, and -ngari meaning “belong to”. Our country covers 16,040 km^2 of land and 11,896 km^2 of sea country. We are Saltwater people who have been living along the coast for thousands of years.

Our Indigenous Ranger team is guided by our 10-year Healthy Country Plan and our Elders and Cultural Advisors. We combine traditional knowledge with western science and modern technology to look after our country for future generations. Key programs include fire, feral animal and weed management, sea patrols, marine species monitoring and management, threatened species, training and skills development, carbon abatement, Indigenous knowledge transfer, cultural activities and visitor management.

Since 2018, Dambimangari have worked in partnership with the Australia Wildlife Conservancy (AWC) on fire, feral animal and weed management and threatened species conservation, with a focus on building Dambimangari’s skills and capacity.

Azarnia Malay – Dambimangari Ranger

My family group is Morlumbun, and I’m from Malarndoom country in the North of Dambimangari. I’ve been a Ranger for four years, and now I’m focusing on biodiversity and threatened species. I started this job because I want to encourage young people and care for my country. My ranger job makes me who I am. My grandmother was a strong woman I always looked up to for guidance. Now she’s left us, I want to carry on what she taught me for younger ones about how to respect and look after country.

Amelia Hurrell – Dambimangari Ranger

I’m a Worrora woman from Larinyuwar on the southern part of Dambimangari country. I’ve been a Ranger for a year now and done lots of work with AWC on significant animals that are important to our culture. As a child I was always taken out to my grandfather’s country at Yaloon, where my oldest uncle Sam Umbagai told me dreamtime stories and taught us to respect country and not to harm it, or the animals and spirits of the land will get angry. I love being a ranger. It’s the best job I’ve ever had. I get to go out on our beautiful country, learn and share my knowledge with my children and families.

Larissa Potter – Australian Wildlife Conservancy

Larissa is a Senior Field Ecologist with the Australian Wildlife Conservancy (AWC) in the Kimberley region, WA. She has spent several years working in northern Australia, with her current role helping to develop the science program for AWCs partnership with Dambimangari Aboriginal Corporation. This involves working closely with Traditional Owners and Rangers to conduct biological surveys for threatened and culturally important species, inform fire, feral animal and weed management, provide training opportunities and capacity building for Rangers, community engagement and increasing knowledge of Dambimangari Country in a culturally appropriate way.

PLENARY

MUSEUM COLLECTIONS AND CONTEMPORARY AUSTRALIAN MAMMALOGY

Kevin Rowe

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Museum collections are a global resource comprising more than 10 million neontological mammalian specimens spanning more than three centuries. Australian collections alone house more than a quarter of a million material specimens of mammals. Museum collections house the specimens upon which the scientific names of nearly 2 million species are based and provide the material needed to describe the millions more expected to be revealed by taxonomy in this century. They are a rich record of life on our planet during the rapid globalisation of human impacts on ecosystems and species. The contemporary growth of museum collections in the 21st century reflects the changing values and technological opportunities of mammalogy and other biological disciplines. Machine and human observations provide an increasing proportion of records in collections, but the imperative to record living biodiversity with material specimens remains. Using primarily examples from my research on rodents and other small mammals, but drawing from exceptional examples of mammalogy at Australian museums, I will attempt to place the value of museum collections in contemporary mammalogy with a view to their future value.

Bio: As Senior Curator of Mammals at Museums Victoria, Kevin Rowe leads an integrative scientific collections-based research program in mammalogy. His research, focussed on the evolution, ecology and conservation of Indo-Australian rodents is fuelled by fieldwork from Australia to Indonesia.

PLENARY

SEALS AS ECOSYSTEM SENTINELS: A MULTIDISCIPLINARY APPROACH

Rebecca McIntosh[1]

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Conservation science at Phillip Island Nature Parks aims to improve our understanding of marine sentinel species and address the challenges of human-wildlife conflict. Our goals are to strengthen environmental management procedures, improve policy and educate via citizen science and behaviour change programs, using an evidence-led approach. Being a small team - collaboration is imperative to achieve the research objectives.

Fur seals are apex marine predators that forage in the ocean and breed on land, making them more accessible for research, but exposing them to threats from both domains. Anthropogenic threats are typically synergistic and include toxicants in the ocean, climate change and plastics, leading to poor health and mortality. Presented research will explore these threats and describe examples of success as well as more complex or 'wicked' problems that are difficult to solve.

The time required for research to translate to on-ground action can be slow, and the barriers may hinder adaptive management. This inaction can have catastrophic long-term consequences, particularly in this time of rapid change that provides little room for adaptation strategies. Innovative approaches and multidisciplinary collaborations are required to protect species and reduce anthropogenic impacts, and we can only do our best.

Bio: Dr. Rebecca McIntosh is a Marine Scientist at Phillip Island Nature Parks in Victoria with an honorary appointment at the Sydney School of Veterinary Science, University of Sydney. Rebecca studies fur seals as top predators and sentinels of ecosystem change, aiming to inform policy and contribute to community education for marine conservation. Her research experience spans 20 years in not-for-profit, government, university and private sectors. Specific research interests include diet and foraging behaviour; health, ecotoxicity and stress investigations; disease influence on abortion and pup survival; and impacts of marine debris, including human behaviour change programs to reduce plastic inputs to the ocean. Rebecca collaborates with a large multi-disciplined team that uses passive acoustic recorders, drones and remote systems to gather data with reduced disturbance to the seals and seabirds inhabiting offshore islands. She co-built a global citizen science project to count seals from drone images, using outputs to develop rapid (real-time) counting of seals through artificial intelligence and machine learning. Rebecca enjoys diving, surfing and exploring wild places.

Alphabetical list of abstracts for ORAL PRESENTATIONS (by presenting author)

FLEXIBLE TORPOR IN SQUIRREL GLIDER: AN ADAPTATION TO UNPREDICTABLE CLIMATE?

Kathrin H. Dausmann [1,2], Gerhard Körtner [2], **Yaara Aharon-Rotman [2]**, Shannon Currie [3] & Fritz Geiser [2]

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[2] Centre for Behavioural and Physiological Ecology, Zoology, University of New England, Armidale NSW 2351, Australia
[3] Department of Evolutionary Ecology, Leibniz Institute for Zoo and Wildlife Research, Alfred-Kowalke-Straße 17, 10315 Berlin, Germany

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Torpor is a highly effective response to counter various ecological and physiological bottlenecks in endotherms. Proximate triggers beyond low ambient temperature and lack of food in less resourced seasons are poorly understood and evidence is increasing that torpor is a much more flexible and widespread adaptation than previously thought. Our study provides the first data on body temperature and heart rate fluctuations in free-ranging squirrel gliders (*Petaurus norfolcensis*) over two seasons (summer/winter) and examines interrelations between torpor use and ambient conditions. Squirrel gliders express torpor at different times during the year, but against expectations torpor seems to be employed flexibly “on demand” rather than seasonally during the coldest and/or the hottest periods. These findings double the size of Australian gliders for which data on torpor are available and further advance our ecological understanding of the dynamics of torpor expression in wild mammals and how animals cope with varying conditions.

THE BENEFITS OF USING PASSIVE AND INTENSIVE MONITORING METHODS FOR A REINTRODUCED GREATER BILBY POPULATION

Cassandra Arkinstall [1], Sean FitzGibbon [1], Kevin Bradley [2], Katherine Moseby [3] & Peter Murray [4]

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[2] Save the Bilby Fund, Charleville, Queensland 4470, Australia
[3] Evolution and Ecology Research Centre, School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, New South Wales 2052, Australia
[4] School of Agriculture and Environmental Science, University of Southern Queensland, Toowoomba, Queensland 4350, Australia

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In Australia, post-release monitoring of reintroduction projects is an area that is often highlighted as being inadequate and requiring improvement. We employed several post-release monitoring methods to understand the health, survival, population growth and spatial ecology of bilbies (*Macrotis lagotis*) reintroduced to a fenced enclosure in south-west Queensland. Monitoring included both passive (microchip-reading antennas, track counts) and intensive (GPS tracking, trapping) methods. Microchip-reading antennas were used to collect survival data and greatly improved the rate of detection for bilbies in the enclosure compared to trapping alone. Track counts were highly variable when bilby density was low but were a useful indicator of population growth and expansion throughout the enclosure. Using GPS loggers enabled us to track and calculate home range sizes, movements, and habitat preferences for multiple bilbies simultaneously, and was far less field intensive than traditional radiotracking methods. Population estimates were successfully obtained from trapping events using spatially explicit capture-recapture models, and important health and reproductive information was collected during trapping. The post-release monitoring methods employed during this reintroduction project included methods novel to bilby research, and highlighted the benefits of employing multiple monitoring techniques. The results will inform improved post-release monitoring in both reintroduced and wild populations.

FERAL PREDATORS AND STOCHASTIC EVENTS: INFLUENCES ON NGWAYIR ACTIVITY TOWARDS THE EDGE OF THEIR RANGE

Hannah Bannister [1,2], Bronte Van Helden [1,3], & Sarah Comer [3,4]

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[2] Centre for Ecosystem Science, University of New South Wales, New South Wales 2052, Australia
[3] Centre of Excellence in Natural Resource Management, University of Western Australia, Albany, Western Australia 6330, Australia
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The western ringtail possum ('ngwayir') is a Critically Endangered marsupial endemic to southwest Australia. We sought to determine the presence and activity of ngwayir at the eastern extent of their range, and to assess whether implementing feral predator control would allow their activity to increase. We monitored ngwayir activity using quarterly spotlight surveys and feral predator activity using a remote camera array beginning in 2020, shortly before predator control commenced. The implementation of predator control coincided with a decrease in fox activity, while cat activity remained stable but low. Ngwayir activity initially declined but then steadily increased over the monitoring period, although remained lower than the initial survey. A fire unexpectedly impacted part of our study site after our initial survey and so we also compare ngwayir activity in burnt and unburnt habitat. Fox control appears to be having some effect on fox activity, however it must be maintained as activity remains above 5 detections per 100 trap nights, likely through reinvasion. Whilst the confirmation of a self-sustaining population at the periphery of its range bodes well for the species, a continuation of monitoring will be needed to assess the long-term impacts of predator control on the ngwayir population.

SPEED TALK

MEASURING THE NAIVETY OF EASTERN BARRED BANDICOOTS TOWARDS CATS AT VARIOUS STAGES OF THE PREDATION SEQUENCE

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Prey naivety has been a recent focus of behavioural ecology to assess the impact of introduced alien predators on native prey species. Eastern barred bandicoots (EBBs) have experienced severe population declines across their Tasmanian range, mostly attributed to habitat modification and degradation, and the introduction of novel predators, such as cats. Empirical and anecdotal data suggests EBBs do not have the ability to recognise cats as predators, however EBBs maintain a population stronghold in cat dense, urban environments. We aim to unpin the current naivety and anti-predator behaviours of EBBs to cats at different stages of the predation sequence, immediate response, cue recognition and landscape of fear.

First, we measured baseline giving up densities (GUD) of wild bandicoots in cat controlled vs non-controlled landscapes. Second, evaluated predator cue recognition of bandicoots by adding predator integumental cues to the GUDs. Lastly, we simulated a predation event to identify key anti-predator response mechanisms, such as flight initiation distance, acceleration, vigilance (pre/post attach) and vegetation use. Results will be presented at the conference.

This data provides insight into understanding the complexity of learning behaviours towards introduced predators, which is an important step in deciphering conservation actions and management plans for EBBs.

CLIMATIC, ENVIRONMENTAL, AND BIOLOGICAL FACTORS INFLUENCE EUROPEAN RABBIT INVASION HOT SPOTS IN THE NULLARBOR REGION

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There is little information about how invasive species interact with native wildlife at broad spatial scales. Here, we document the joint distribution of competing burrowing species, the European rabbit (Oryctolagus cuniculus) and Southern Hairy-nosed wombat (Lasiorhinus latifrons), and their relationship with biophysical broad-scale controls. We test the hypothesis that native species may play a role in reducing the impact of invasive species.

Rabbit and wombat burrows can be readily detected and distinguished in high-resolution satellite imagery. This allows the development of a spatially unbiased set of observations at high numbers. For a 3 million ha region of the Nullarbor Plain we scanned 1000 randomly placed 1km^2 sites and digitized all wombat and rabbit warrens contained within. We used species distribution modelling (MaxEnt) of rabbits to evaluate complex and potentially interacting environmental interactions.

We found the highest rabbit warren densities at high temperature and low rainfall and a strong negative relationship with wombat density. Furthermore, the highest densities of rabbits were found at lower and higher margins of preferred wombat habitat variables. This documents the role of species interactions and clearly visualises realized niches for an invasive species competing with a native mammal. It may also indicate that high wombat densities reduce the risk of high rabbit numbers.

NOT SO VULNERABLE? HIGH JUVENILE SURVIVAL AND CHANGES IN SHELTER USE IN A REINTRODUCED POPULATION OF WESTERN QUOLLS

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Juvenile survival and dispersal are the primary means of population expansion in reintroduction projects. The establishment of a reintroduced population of western quolls (*Dasyurus geoffroii*) in the Ikara-Flinders Ranges National Park has been successful, despite predation by feral cats in the beginning. Cats are now targeted through Eradicat baiting within a smaller area of the park where the core quoll population is present. However, cats are still present in the park and juvenile quolls may also disperse outside of the control areas, putting themselves at increased risk of predation. We radiotracked juvenile quolls to assess their survival, habitat, and shelter site use during natal dispersal. No quolls died during the twenty-six weeks of monitoring. All females remained within the cat-control area while 16.7% of male quolls moved outside control area. Differences in shelter site usage were identified, with the original juvenile cohort primarily using rabbit warrens as daytime shelter sites, whereas the 2020/21 cohort used more natural hollows, suggesting a possible increase in familiarity of the release site by parents and resultant filial transfer. At present, juvenile females have space to remain within the baited area but ongoing monitoring of the population as it expands beyond control area is recommended.

☺ Student presentation

POPULATION RECOVERY AND GENETIC RESCUE OF BLACK-FLANKED ROCK WALLABIES (*PETROGALE LATERALIS LATERALIS*) IN THE WESTERN AUSTRALIAN WHEATBELT

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Elevated inbreeding and exposure of deleterious genetic variation (genetic load) during population bottlenecks often drive loss of fitness (inbreeding depression), exacerbating population declines. In response, conservation managers seeking to alleviate bottlenecked populations may introduce individuals from genetically divergent populations, although the success of these efforts can be variable and are influenced by several factors. During the early 2010s, major declines in black-flanked rock wallaby (*Petrogale lateralis lateralis*) populations within the Western Australia Wheatbelt region necessitated management actions including translocations across populations. We will use genomic (ddRAD-seq; *n* = 239), whole-genome (*n* = 30) and demographic information collected across 8 populations over the last 20 years to assess the impact of these efforts on the genetic diversity, inbreeding, genetic load and recovery of *P. l. lateralis* populations. Here, I present an initial assessment of genomic diversity, highlighting the impact of bottleneck events and translocations on genetic diversity. I also describe future work using complex genetic and demographic simulations to determine the success of these efforts in reducing inbreeding and genetic load over short- and long-term timescales. This research will contribute to future management recommendations for these fragile populations, as well as our understanding of the efficacy of population mixing efforts.

TRICKY STICKIES:
MONITORING HARD TO DETECT MAMMALS IN NESTS AND TREES

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Developing reliable methods to monitor hard-to-detect species can be challenging for species conservation and management. The Greater Stick-Nest Rat (*Leporillus conditor;* GSNR) and Red-tailed Phascogale (*Phascogale calura;* RTP) are two such species that have recently been reintroduced into a fenced safe-haven at Mt Gibson Wildlife Sanctuary in Western Australia. Known for their distinctive nests, GSNR build grand shelters out of piles of sticks. Semi-arboreal, RTP reside in tree hollows and are capable of extraordinary feats such as leaping up to 2m between tree canopies. Located within the pre-European habitat range for both species, Mt Gibson is semi-arid, characterised by a mix of Eucalypt woodlands and Acacia shrublands. Here we present the outcomes of various methods trialled to effectively monitor GSNR and RTP following their reintroduction to Mt Gibson. Using a combination of knowledge from intensive pre-surveying and novel carpentry, we are now able to calculate site-abundance estimates for both species. The development of these protocols has great potential to benefit the future conservation and effective management of two vulnerable mammal species in Australia.

TRANSLATING CONSERVATION GENETICS: LESSONS LEARNED FROM THE 2019-20 BUSHFIRES

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Environmental catastrophes are increasing in frequency and severity under climate change, and they substantially impact biodiversity. Recovery actions after catastrophes depend on prior benchmarking of biodiversity and that in turn minimally requires critical assessment of taxonomy and species-level diversity. Long-term recovery of species also requires an understanding of within-species diversity. Australia's 2019–2020 bushfires were unprecedented in their extent and severity and impacted large portions of habitats that are not adapted to fire. Assessments of the fires' impacts on vertebrates identified 114 species that were a high priority for management. In response, we compiled explicit information on taxonomic diversity and genetic diversity within fire-impacted vertebrates to provide to government agencies undertaking rapid conservation assessments, including population genomic assessments of more than 30 species. Here we discuss what we learned from our effort to benchmark pre-fire taxonomic and genetic diversity after the event.

EVIDENCE OF MALE ALLIANCE FORMATION IN A SMALL DOLPHIN COMMUNITY

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The photo-identification of uniquely marked individuals has revealed much about mammalian behaviour and social structure in recent decades. In bottlenose dolphins (*Tursiops* spp.), for example, the long-term tracking of individuals has unveiled considerable variation in social structure among populations and various spatio-temporal aspects of group formation. In our study, we investigated associations among individual males in a small community of Indo-Pacific bottlenose dolphins (*T. aduncus*) residing in an urbanized estuary in southwestern Australia. Given the relative proximity of our study area to other populations in which complex male alliances form for the purpose of mate acquisition, we used long-term photo-identification records and social analyses to assess whether such alliances also occur in smaller and more isolated settings. Our work revealed strong social bonds and long-term, non-random associations among individual males, suggesting the occurrence of male alliances. Behavioural observations of alliances interacting with potentially receptive adult females from the estuary community and from adjacent communities, and exhibiting sexual display behaviours near females, suggest that these alliances occur in a reproductive context. As the first formal analysis indicating the occurrence of male alliances outside Shark Bay along the vast western coastline of Australia, this study complements previous research and extends our understanding of the evolutionary and ecological processes that drive alliance formation.

A “LEAKY BOAT” STRATEGY FOR FOX MANAGEMENT IN A PERI- URBAN RESERVE.

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The Royal Botanic Gardens Victoria, Cranbourne (RBGVC) is one of the oldest predator exclusion sites in Australia. Over the past 25 years the 400 ha fenced site has been engulfed by an inexorable wave of urbanization that has transformed a region dominated by rolling farmland into an increasingly hostile matrix of houses, roads, fences and introduced predators. Both foxes and cats occur at high density in this landscape and appear to gravitate to fragmented and isolated patches of remnant vegetation that provide refuge, prey and denning sites.

Complete, long-term exclusion of foxes from the RBGVC has proven problematic and a small number are now "tolerated" within the reserve. Management has become an ongoing plug-and-bail strategy that requires continual fence maintenance, predator and prey monitoring and baiting to stop the fox population exceeding a predetermined threshold. Indexes of abundance from passive bait-take, print deposition and camera monitoring are used to assess the effectiveness of control actions and build a long-term picture of population dynamics.

WHAT DOES SURFACE TEMPERATURE TELL US ABOUT THE HEAT BALANCE OF FREE-LIVING NUMBATS?

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Thermoregulation is an essential physiological function for most mammals and poses a major energetic and hygric cost. The myrmecophagous numbat has a low energy-density diet so an energetically-efficient thermal biology is especially advantageous. Here we use thermal imagining to examine the surface temperature (T_s) of wild, free-living numbats, exploring avenues of heat exchange and identifying opportunities and challenges posed by the thermal environment for this unique marsupial. Numbat T_s was significantly related to wet bulb globe temperature (WBGT). The face T_s (33.6°C) most closely approximated body temperature and was related to WBGT with a slope (0.44) significantly lower than 1. The nose tip and tail were significantly cooler (< 26.3°C) and most closely (0.92) approximated a slope of 1 with WBGT. Anterior and posterior body surfaces were less insulated (T_s =32.1, slopes >0.81) than ventral surfaces (T_s ≤31.5°C, slopes <0.79), presumably facilitating solar heat gain. The thermal impact of the posterior stripes was negligible and there was no evidence that numbats use thermal windows to enhance heat loss. Patterns of T_s with WBGT and black globe temperature suggest that pilo-depression and increased evaporative water loss reduce T_s at higher WBGTs. This study highlights the utility of modern thermal imaging technology for non-contact measurement of thermal variables, allowing us to better understand the physiological capacity of animals in their natural environment.

HOW DO PERSONALITY, REHABILITATION PROTOCOL AND RELEASE METHODS AFFECT SURVIVAL IN REHABILITATED WESTERN RINGTAIL POSSUMS – PRELIMINARY RESULTS

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Each year wildlife carers rehabilitate up to 200 critically endangered western ringtail possums, *Pseudocheirus occidentalis*. Only 25-50% survive and are released, but so far little was known about their fate due to lack of monitoring. We are investigating how personality, preparation for release and release methods affect their survival. Possums are placed in a pre-release facility to standardize conditions and their personality is evaluated. They are released at sites containing suitable habitat and under fox control and are radio-tracked to assess survival. All fatalities are retrieved and causes of demise determined including melt curve analysis to detect predators' DNA.

Two groups of 20 possums each were released near Yallingup (WA) in Spring 2019 and 2020. Of the first group, just one survived (5%); from the second group, four possums (20%), survived possibly due to dedicated shooters dispatching a cat and four foxes. Two additional groups of 20 possums each were released in Autumn and Winter 2021 near Margaret River. Despite intensive shooting eliminating 44 foxes, only 10 survived with 50% of fatalities caused by foxes. Approximately 100 foxes have been eliminated in the Margaret River area, raising the survival of possums released in 2022 to 50% (study on-going). These results highlight the importance of fox control and will underpin future management guidelines for the release of rehabilitated possums.

SPEED TALK

THE SECRET LIFE OF NORTHERN QUOLLS: REVEALING THE IMPACT OF MINING DISTURBANCE ON THIS THREATENED CARNIVORE

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Anthropogenic disturbance in a landscape can influence animal movement and behaviour by altering the habitat composition and introducing or removing certain resources such as food, water, or denning locations. Mining in Australia is an anthropogenic disturbance which destroys natural habitats, while resource subsidies such as food at mine camps may attract larger predators such as dingoes and feral cats. Northern quolls (*Dasyurus hallucatus*) are a nocturnal mesopredator threatened by mining in the Pilbara region of Western Australia, however, the impacts of mining on the movement and behaviour of northern quolls are relatively unknown. Filling this gap is important because mining often displaces quolls from favoured habitat and potentially forces them to use unsuitable habitat (e.g., mine sites) which may increase exposure to threats such as increased predation or reduced habitat connectivity. I used GPS collars to monitor the movement of northern quolls living in a mining landscape during the breeding and non-breeding seasons and used camera traps to monitor larger predators within mining and natural areas. I will touch on some of the patterns emerging from my early analyses, what they might mean for northern quolls living in mining landscapes, and where to go from here.

TAMMAR TIME CAPSULE: POPULATION GENETICS OF TAMMAR WALLABIES REINTRODUCED TO THE SOUTHERN YORKE PENINSULA, SA, 18 YEARS SINCE THEIR RETURN TO THE MAINLAND.

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Tammar wallabies (*Notamacropus eugenii eugenii*) went extinct on mainland South Australia by the 1930s. From 2004 to 2008, 131 wallabies were reintroduced back to the mainland at Dhilba Guuranda-Innes National Park, sourced from an introduced population in New Zealand. Despite evidence of moderate population growth in the 18 years since release, there had been no formal assessments of their distribution or population genetics to explore population sustainability and inform future management strategies. Our research aimed to apply autosomal and sex-linked microsatellites to assess the current population genetics, using faecal DNA from a scat survey across the park, and to compare this against the founding genetics accessible via historical tissue samples. Whilst our scat survey was unsuccessful due to misidentification in the field, our reassessment of historical tissues provided important insights for future analysis. Whilst autosomal diversity was moderately high, X-chromosome diversity was comparatively low, especially in offspring samples, which provides potential evidence of a genetic bottleneck that could impact the long-term sustainability of the population. Our research underscores the need for all reintroduction programs to plan and invest in pre- and post-release genetic monitoring to ensure that such programs establish both genetically and demographically sustainable populations of reintroduced native species.

☺ Student presentation

THE CURIOUS CAT: INTERACTIONS AND VISITATION RATES BY FERAL CATS AT ARTIFICIAL REFUGES

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Studies of artificial refuges tend to report the use by target species; few studies report use by non-target species. Artificial refuges can act as ecological traps, increasing the abundance of prey species in an area, while also attracting potential predators to the area. Predators like feral cats (*Felis catus*) target hunting around areas of greater prey activity, and often revisit refuges, which decreases their search time and increases hunting efficiency. This study investigated interactions and visitation rates by feral cats at artificial refuges on two Bush Heritage Australia properties. Experimental sites were paired in disturbed and intact sites at Eurardy reserve and in low and high stock impacted landscapes at Hamelin reserve, replicated four times. Sites consisted of 4 plots, with three artificial refuge types (corrugated iron, pallets or fence posts) and a control plot. Predators were monitored using camera traps. Preliminary findings show cats visit and interact with artificial refuges, investigating and scent marking. Non-target species were also identified at artificial refuges. Early analysis shows that cats are attracted to artificial refuges, which could therefore act as an ecological trap for prey species. This study will test the predator resilience of different refuge designs.

☺ Student presentation

Presentation, presented remotely

REPRODUCTIVE BEHAVIOUR OF CAPTIVE SHORT-BEAKED ECHIDNAS: A FOCUS ON QUANTIFIABLE CHANGES BEFORE AND AFTER OESTRUS AND OVIPOSITION

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Current knowledge regarding echidna reproductive behaviour is based on qualitative measurements; therefore, it is unclear if specific behaviours could be utilised in captive reproductive management. This study aimed to identify and determine if quantitative changes in behaviour of echidna breeding pairs could facilitate the detection of oestrus and impending oviposition. Five echidna breeding pairs were monitored daily for seven reproductive and eight general behaviours. After confirmed copulation, females were monitored for four egg-laying and 8 general behaviours until egg incubation. General observations of reproductive behaviours during the 2018-2020 breeding seasons were recorded as part of routine husbandry. For breeding pairs, there was a significant rate of change over time before and after copulation for the behaviours ‘urogenital sniffing’, ‘rolling’ and ‘copulation attempt’. For pregnant females, time engaged in ‘pacing’ significantly increased while ‘time eating’ and the ‘quantity of food eaten’ significantly decreased on the day of oviposition. While unable to identify oestrus from specific behaviours, our observations suggest that the female echidna’s period of receptivity is less than 24 hours. This study demonstrates that there are quantifiable changes in specific echidna behaviours that can be incorporated into zoo husbandry practices to improve the reproductive management of this species.

8,820 PITFALL TRAP NIGHTS: A PRELIMINARY ANALYSIS

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Pitfall trapping is widely used for sampling small terrestrial vertebrates. Here, we present a preliminary analysis from an extensive array of pitfall traps across three national parks in sandplain and spinifex dune mallee in New South Wales. Surveys were run during spring and autumn 2020 – 2022, with a total of 1686 array trap nights and an average capture rate across all vertebrate species of 0.75. Mammal capture rates were lower with an average of 0.55 when all species were pooled, while the most commonly caught native mammal was *Sminthopsis murina* with a capture rate of 0.1.

We investigate the relationship between capture rates across sites as well as across season for *Ningaui yvonnea*, *S. murina* and *Mus musculus.* We undertake a more complex analysis of *S. murina* using body condition analysis and show that body condition is higher in spring than summer, but does not appear to vary between sites. Further to this, we examine the low capture rates of the lesser seen *Antechinomys laniger* as well as more common *Antechinus flavipes*.

HOW TO KILL FOXES:
DOES AERIAL BAITING CONTROL FOXES IN MESIC ENVIRONMENTS?

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European red foxes threaten some native fauna and are often subject to lethal control. However, fox control efficacy is rarely measured. In eastern NSW, aerial baiting for dingoes and other free-ranging dogs is conducted to prevent predation of livestock and is conducted in forested country where foxes co-occur. For effective fox control to occur, fox mortality rates from dingo control must exceed fox rate of increase. We sought to quantify mortality rates among 37 red foxes and 38 dingoes fitted GPS-VHF telemetry collars when exposed to linear aerial baiting rate for dingoes at 10 baits km^{-1}.

Aerial baiting for dingoes was efficacious for foxes, but not dingoes: 96% of collared red foxes and 55% of collared dingoes exposed to aerially deployed dingo baits died. This is sufficient for on-going population decline in foxes, but not for dingoes. No unexposed foxes or dingoes died, and no deaths of collared foxes could be attributed to dingoes or *vice versa*. We discuss the ecological and conservation consequences of the lethal control of foxes in mesic environments of eastern NSW.

FOOD FIGHT? DIETARY OVERLAP IN AUSTRALIAN EUTHERIAN PREDATORS

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Introduction of the domestic cat and red fox have had a devastating impact on Australian native fauna. There is considerable debate about whether dingoes can successfully suppress the two recently introduced mesopredators. To inform this discussion, I summarised dietary overlap values (O_{ij}) for 46 studies that presented diet composition of two or all three of these predators. The strongest factor influencing dietary overlap values was the predator species being considered: the greatest dietary overlap was between cats and foxes (O_{cf}=0.79±0.20, n=37 location/time points), an intermediate value for foxes and dingoes (O_{fd}=0.73±0.21, n=42), and the least overlap was between cats and dingoes (O_{cd}=0.64±0.27, n=24). There was greater dietary overlap between predator species in arid sites (effect of average annual rainfall: P=0.001) and at sites with the most intact vegetation (vegetation condition: P=0.021). There was greater dietary overlap for older studies (P=0.047); this could reflect successful rabbit biocontrol over time although the amount of rabbit prey in predator diets had only weak relationship with dietary overlap values (retained in the top model, but P=0.305). Whether or not the study was carried out during periods of rodent irruption was not retained in the top model (although there were scarce data for rodent irruption times). Such evidence has broad conservation implications as the introduction of dingoes as part of re-wilding programs is gaining interest.

THE SURVIVAL AND RECRUITMENT OF REINTRODUCED BRUSH-TAILED BETTONGS *(Bettongia penicillata)* 12 MONTHS IN A PREDATOR SUPRESSED LANDSCAPE.

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Marna Banggara is an ambitious rewilding project that looks to return up 12 native Australian animals to the southern Yorke peninsula over the next 20 years. This landscape intersects tourism, cultural significance, domestic living, farming, and is also invasive predator suppressed (but still active to a degree).

The flagship release of Marna Banggara occurred in August 2021 with 40 critically endangered brush-tailed bettongs (*Bettongia penicillata*) reintroduced to Dhilba Gurranda-Innes national park, SA. These 40 bettongs were sourced from an extant population on Wedge Island, SA. In June/July 2022, a further 44 were translocated from wedge island as well as 36 from wild and sanctuary populations near Manjimup, WA.

During the 12 months post initial release, the translocated animals have been monitored in part through seasonal trapping. This has provided insight into the population health, breeding, and recruitment and seen all relevant KPI's achieved.

Overall, more than 70% of located females had pouch young, 7 BTB born on the peninsula have been trapped and tagged, various health indicators (weight, ectoparasite levels etc) have had positive trends overall, and recorded predator mortalities have been minimal despite persisting low levels of recorded foxes and cats in the park.

SPEED TALK

THE "BOULLANGER ISLAND" DUNNART *SMINTHOPSIS FULIGINOSUS*: A FEISTY LITTLE BATTLER HANGS ON!

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Boullanger Island (25-30 ha), off Jurien Bay on the west coast of Western Australia, support two native mammal species, the dibbler *Parantechinus apicalis* and the dunnart *Sminthopsis fuliginosus* as well as the introduced house mouse *Mus musculus.* While intensive work on the dunnart and its interactions with other vertebrates on the island was carried out between 1988 and 2007, subsequent activity has been limited to incidental monitoring of the species alongside more detailed conservation and recovery actions focussed on the island's dibbler population.

The greater part of Boullanger Island is a body of sand deposited between two prominent limestone outcrops. Significant physical and biotic changes to the sandy portion since 2010 and particularly to dunnart's preferred habitat may have posed challenges to the survival of the Boullanger Island population. Erosion of the southern side of the island has reduced the area of established low vegetation, and subsequent periodic inundation with seawater through storm surges has caused the death of all mature *Acacia cyclops* individuals, which previously provided canopy cover in the eastern section of the island where most dunnarts were found. Despite these changes, annual pit-trapping over the last five years has shown that dunnarts persist, at least in small numbers.

FOREST FIRE MANAGEMENT, CONTROL CHARTS AND THE PROTECTION OF THREATENED SMALL MAMMAL POPULATIONS IN SOUTHWESTERN VICTORIA

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Fire management in Victoria aims to achieve the goals of bushfire risk reduction, life and asset protection and biodiversity conservation. These goals are encapsulated within the *Victorian Bushfire Code of Practice* and *Biodiversity 2037*. In western Victoria populations of the EPBC Act listed mammal species swamp antechinus, heath mouse, long-nosed potoroo and southern brown bandicoot are key assets for protection from inappropriate fire. To deliver the goals, Forest Fire Management Victoria (FFM Vic) have developed a management effectiveness monitoring and evaluation framework that considers biodiversity risks at scales from the landscape to the site. This presentation outlines research that trials the use of time series control charts to identify if risks to management objectives are changing. Control charts provide a numerical, unbiased management control limit from repeat surveys that allow early detection of population trends. They allow managers to see trends in populations of species or communities early and provide additional evidence of management effectiveness in support of traditional experimental approaches. Long-term changes in habitat characteristics using time-series NDVI derived from satellite data and breaches of trap capture management thresholds for swamp antechinus are two case studies considered within the winter (unbounded) planned burn programme in Victoria.

DIET OF THE INVASIVE RED FOX IN THE PILBARA, WESTERN AUSTRALIA, WITH A FOCUS ON NATIVE SPECIES PREDATION

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Invasive species, such as the introduced red fox (*Vulpes vulpes*), are key drivers of species decline and extinctions of native Australian mammals, reptiles, and birds, and play an important role in the predation suppression of many threatened species. This study describes fox diets in the Pilbara (1) to determine their impact on native species and (2) compare methods for dietary analysis. Morphological analyses were conducted for 144 scats and 22 dissected gastrointestinal tracts (GIT) collected from Mundabullangana Station and Onslow between 2016-2018. Approximately half (47.9%) of scats and two thirds (69.6%) of GIT contained native mammals, with macropods (scats: 44.4%, GIT: 60.9%) having the highest frequency of occurrence (FOO). Northern quoll (*Dasyurus hallucatus*) remains were identified, providing the first record of this species in fox diet. Over a quarter (27.8%) of scats contained native reptiles, including the conservation significant flatback turtle (*Natator depressus*, FOO=7.6%). We reveal impacts of foxes on native fauna. Further genetic analysis will be carried out to detect species that were not identifiable through morphological analysis. Impacts were identified on at least two threatened species, providing additional support for fox management projects in this region.

☺ Student presentation

PRELIMINARY EVIDENCE FOR THE LOSS OF ANTI-PREDATOR RESPONSES FROM A HAVENED MAMMAL POPULATION

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Because invasive predators pose a threat to Australian mammals, we are increasingly preserving threatened populations within predator-free havens. Inside these havens in the absence of predators, traits that once provided individuals with some protection against predation (such as neophobia) become useless and costly. Consequently, in havened populations these traits may be selected against, rendering individuals unfit for reintroduction into areas where predators remain. Using a routine capture and spotlight monitoring dataset spanning 10 years, we aimed to reveal any evidence for the loss of anti-predator responses from a havened population of woylies (*Bettongia penicillata*) in the South West of Western Australia. We identified six behavioural and morphological traits relating to predator escape and used these metrics to draw a paired comparison between a havened and non-havened population of woylies who share identical evolutionary histories. The results highlight population-level differences in the behaviour and morphology of havened and non-havened woylies, providing preliminary evidence for the loss of anti-predator responses from the havened population. Our study paves the way toward a conceptual and mechanistic understanding of the loss of anti-predator responses, which is essential if we are to aim for the persistence of havened species outside of predator-free havens.

☺ Student presentation

DENSITY ESTIMATES REVEAL THAT FRAGMENTED LANDSCAPES PROVIDE IMPORTANT HABITAT FOR CONSERVING AN ENDANGERED MESOPREDATOR, THE SPOTTED-TAILED QUOLL

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Native predators are increasingly exposed to habitat loss and fragmentation globally. When developing conservation and management strategies, it is important to determine whether fragmented landscapes can still support similar predator densities to intact areas, and thereby constitute important habitat for these species. The spotted-tailed quoll (*Dasyurus maculatus*) is an endangered Australian mesopredator that is often considered to be forest-dependent. While quolls are known to occur in some fragmented forest landscapes, it is unclear whether these areas represent sub-optimal habitat where quolls merely persist, or whether quolls can still thrive at densities similar to those observed in intact forest landscapes. We used camera traps to detect quolls in both a fragmented and intact forested site, over three years. We used each quoll's unique pelage pattern to identify individual quolls and estimate population density at each site. We were able to assign more than 94% of quoll image sequences across both sites to identify 173 individuals during the study. Density estimates of 0.13-0.66 quolls per km^2 at the fragmented site were comparable to estimates of 0.28-0.48 quolls per km^2 at the intact site. Our results highlight the importance of retaining and protecting forest fragments for the conservation of endangered quoll populations.

☺ Student presentation

MANAGEMENT OF AN ISOLATED POPULATION OF A THREATENED MACROPOD: BLACK-FLANKED ROCK-WALLABIES IN THE AVON VALLEY

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The Australian Wildlife Conservancy's Paruna Wildlife Sanctuary in the Avon Valley east of Perth supports a small yet stable population of Black-flanked Rock-wallabies, a habitat specialist restricted to complex rocky outcrops. The Paruna population was successfully reintroduced; translocations of 87 individuals occurred between 2001-2007. Annual trapping data indicates that the Paruna population has remained stable following the initial reintroduction. Population estimates ranged from 10 to 22 individuals (95% CI 4 to 50 individuals) between 2011 and 2020, and physiological and reproductive health metrics have remained consistent over time. A varied history of additional monitoring methodologies (scat, radio-tracking, spotlighting, camera) was employed to assess spatial distribution, habitat use, and animal movement. Immigration and emigration of individuals between Paruna and other reintroduced populations in the adjacent Walyunga and Avon-Valley National Parks was expected, though whether such movements have occurred remains poorly known. Analyses conducted soon after reintroduction (2010) indicated sound genetic health. Given the isolated status and small size of the Black-flanked Rock-wallaby population at Paruna the impetus for intensive monitoring and management is significant. New population management plans are imminent, and strategies may include genetic analyses, genetic supplementation, and investigations into resource availability/use and competition with feral predators and herbivores.

ONLINE PRESENTATION

TAXONOMIC INVESTIGATION OF GREATER GLIDERS (*PETAUROIDES VOLANS*) USING 3D GEOMETRIC AND LINEAR SKULL MORPHOMETRICS

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Taxonomy and conservation are linked. Without a valid taxonomic description and sufficient knowledge about a species ecology; one cannot protect a species and conservation can be crippled. An endangered species originally thought to be singular might be rarer than previously believed, and therefore calls for early species delimitation for implementation of tailored and effective conservation strategies. For the first time, this study investigates differences in skull morphology using 3D geometric and linear morphometrics of the endangered Greater Glider (*Petauroides volans*). 166 greater glider skull specimens were selected along a latitudinal cline from the Australian Museum, Museums Victoria, Australian National Wildlife Collection (CSIRO) and the UNE Natural History Museum. The skulls were 3D scanned, landmarked, and measured between December 2021 and July 2022. Differences in shape and size were assessed using 21 superimposed landmarks and 17 linear measurements. Preliminary results indicate that two specimens were mis-identified as greater gliders, and cranial shape is possibly linked to allometry and ontogeny. Our results from this study will not only highlight the anatomical differences in skull morphology between the three recently recognised greater glider species (*P. minor*, *P. armillatus* & *P. volans*), but aim to support the taxonomic delimitation for future species-specific conservation options.

VALIDATION OF FAECAL GLUCOCORTICOID METABOLITE ANALYSIS IN KOALAS AS A CONSERVATION PHYSIOLOGY TOOL

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In 2022, the koala was listed as endangered in QLD, NSW and the ACT under the Environment Protection and Biodiversity Conservation Act 1999. To better understand anthropogenic, disease and environmental pressures on the health and viability of koala populations we need better tools to understand the physiological response of these animals under pressure. The aim of this project was to validate faecal glucocorticoid analysis techniques for the koala. Daily faecal samples were collected from koalas (n = 8) undergoing hospital treatment for chlamydia or trauma. Faecal samples were dried, weighed (0.2g) and extracted with 5mls 80% methanol prior to analysis. A total of 7 different enzyme-immunoassays (EIAs) were tested which included EIAs with antibodies against cortisol, corticosterone and three different glucocorticoid metabolites. Biologically relevant changes in faecal glucocorticoid metabolite concentrations were demonstrated by 3 of the 7 EIAs including two cortisol and one corticosterone EIAs. The metabolite specific and other corticosterone EIAs failed to pick up biologically relevant changes in faecal metabolite concentrations. These results will contribute to the development of an index of normal and abnormal faecal glucocorticoid levels and patterns to provide context for the evaluation of the health of wild koala populations to enhance the determination of cause and effect relationships, and better inform conservation and management decisions.

STRANDINGS IN ST VINCENT GULF BIOREGION, SOUTH AUSTRALIA: 12-YEAR STUDY PROVIDES BENCHMARK FOR MONITORING BIOLOGY AND PATHOLOGY OF CETACEANS IN AUSTRALIA

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The semi-enclosed environment of St Vincent Gulf is impacted by many human activities and long-term monitoring of cetaceans is vital. Records of collected specimens (173) and those not examined by the South Australian Museum (98) were analyzed for 2009–2020. Necropsies were performed on most collected carcasses using gross, histopathological, and diagnostic assessment of pathogens, organs and skin lesions. Relative age and circumstance of death were assigned. Baleen whales (5 species) and odontocetes (8 species) were recorded. Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) and common dolphins (*Delphinus delphis*) were analyzed in detail. Anthropogenic cases were prevalent (21%). Many dolphins were immature males and disease (73%) the most frequently recorded circumstance of death. The most common pathology was inflammatory disease, including infectious pneumonia. In Indo-Pacific bottlenose dolphins this was more prevalent in St Vincent Gulf than the Adelaide Dolphin Sanctuary. Microbe testing confirmed 35 species. Nematodes and trematodes were recorded throughout the study. *Toxoplasma gondii* was observed in an Indo-Pacific bottlenose dolphin. Severe traumatic injury was recorded in many dolphins, including anthropogenic cases. A tumor (leiomyoma) was described from a common dolphin. This study provides an important baseline for future monitoring of emerging infectious and chronic diseases, and anthropogenic threats in the region.

NON-INVASIVE MONITORING AND REINTRODUCTION BIOLOGY OF THE BRUSH-TAILED ROCK-WALLABY (*PETROGALE PENICILLATA*) IN THE GRAMPIANS NATIONAL PARK, AUSTRALIA

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Thirty-nine endangered brush-tailed rock-wallabies (*Petrogale penicillata*) were reintroduced into Grampians National Park, Western Victoria, between 2008 and 2012. Subsequent high mortality, low breeding, and no recruitment was linked to fox predation and constant physical disruption to the colony social structure. From 2014 to 2017, the colony was monitored only by remote camera which identified five adult animals (1 ♂ and 3 ♀'s - all tagged; 1 ♀- untagged). In 2019, camera monitoring and non-invasive faecal genetic monitoring (eleven microsatellites) were used to identify colony members, gender, genetic diversity, and breeding. Camera monitoring identified the same five individuals as 2017, while genetic monitoring identified eight individuals (two ♂ and six ♀ genotypes). Genetic diversity within the colony was moderate (He = 0.520, Ho = 0.691). Camera monitoring alone did not accurately assess rock-wallaby colony size nor structure. Leaving the colony undisturbed after 2013 correlated with increased adult survival and breeding, and successful recruitment of young to the adult population. Recommendations for the Grampians colony include management of potential future inbreeding and continuation of regular camera and faecal genetic monitoring to improve our understanding of the reintroduction biology of *P. penicillata* and other marsupials in open, unfenced landscapes.

☺ Student presentation

DINGO DNA: WHAT CAN WE USE IT FOR?

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The status of the Australian free-ranging dog population is the subject of an ongoing controversy, but genetic studies can assist in its resolution. There are large sampling gaps in previous studies of dingoes of different lineage, which affects conclusions and management recommendations for both livestock protection and dingo conservation. Therefore, we aimed to quantify the proportions of dingo genes from the widest sampling effort across Australia yet attempted, and to identify familial and other relationships between animals to assist in management decisions.

We collected >8,300 DNA samples from captured dingoes across Australia between March 2008– June 2022. Using microsatellite studies with STRUCTURE and Full Sibling Reconstruction analyses, we determined the purity of dingoes across the country and identified familial relationships between individuals, which we mapped.

Most free-ranging dogs in central, northern and western Australia were pure dingoes (80–100% Dingo DNA) and there were more hybrids (>10%–79% Dingo DNA) in the southeast. Relationships between two or more dingoes were found for 38% of samples. Genetic studies can assist in the classification of free-ranging dogs and potentially have a wider application for on-ground management for livestock protection and dingo conservation, which we discuss.

THE EFFECTS OF BUSHFIRE AND REHABILITATION ON HOME RANGES AND MOVEMENTS OF KOALAS

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Bushfires are a major disturbance process in Australia, impacting how various species can move within, and utilise their environment. The 2019/20 bushfires were unprecedented, with many animals suffering, particularly the koala (*Phascolarctos cinereus*). Following the fires, a number of resident koalas from the Snowy Monaro Region in New South Wales were followed using radio-tracking collars in a burnt and unburnt landscape to compare movements. Furthermore, rehabilitated koalas that were in care, were released back into the burnt landscape and tracked, to compare the movements to the resident koalas. 34 koalas were tracked for between 9 and 256 days each (10 rehabilitated koalas, 9 residents in burnt and 13 residents in unburnt). Ages ranged from <2 years to >10 years old and included 16 males and 18 females. Minimum convex polygon sizes varied from 17ha to 2,811ha for koalas tracked minimum 50 days and home range analyses suggest similarly. Seasonal differences were observed, with males moving further than females during spring and summer. Displacement distance was almost 3 times higher for rehabilitated koalas. Our results provide novel and interesting findings for koala movements in this region and show the longer-term impacts of fire on koala movements and rehabilitation effects.

☺ Student presentation

FUTURE-PROOFING THE KOALA: SYNERGISING GENOMIC AND ENVIRONMENTAL DATA FOR EFFECTIVE SPECIES MANAGEMENT

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Climatic, evolutionary, and demographic processes are all inextricably linked to conservation. To investigate the mechanisms underlying population structure and adaptive genetic variation in the koala (*Phascolarctos cinereus*), we employed a combination of exon capture and high-throughput next-generation sequencing. An examination of 250 specimens representing 91 wild source locations revealed that five major genetic clusters of koalas currently exist on a continental scale. The initial divergence of these clusters appears to have been concordant with the Mid-Brunhes Transition (~ 430–300 kya), a major climatic reorganization that increased the amplitude of Pleistocene glacial-interglacial cycles. While signatures of polygenic selection and environmental adaptation were detected, strong evidence for repeated, climate-associated range contractions and demographic bottleneck events suggests that geographically isolated refugia may have played a more significant role in the survival of the koala through the Pleistocene glaciation than in situ adaptation. Our results also demonstrated that existing management divisions in the states of Queensland and New South Wales do not reflect historic or contemporary population structure, and highlighted the importance of aligning the conservation of genome-wide genetic variation with the protection of core koala habitat to increase the species' resilience to accelerating anthropogenic threats.

TESTING RECOVERY MEASURES FOR THE THREATENED EASTERN BARRED BANDICOOT IN TASMANIA

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Eastern barred bandicoots (*Perameles gunnii*), once widespread and common across northern and eastern Tasmania, are in decline. Key threats are: 1) loss of refuge and foraging habitat from agricultural land clearing, 2) predation from high densities of feral cats in the open landscapes where bandicoots live, 3) disease risk of toxoplasmosis from feral cats, and 4) reduction in invertebrate prey due to a warming and drying climate. I will study bandicoots in the Northern Midlands and West Tamar regions, which is now part of their core range and where they are still relatively common. Restoration efforts are focussed initially on this core range, from which learnings will be applied to other more degraded areas. I will present results addressing the following:

1. What are the drivers of bandicoot abundance in Tasmania?
   I will use data from cameras and historic records to determine biotic and abiotic factors influencing bandicoot presence and abundance.
2. What constitutes good habitat for bandicoots?
   I will use GPS tracking devices and scat analysis to determine where bandicoots find food and refuge, in relation to feral cat activity.
3. Do bandicoots respond to restoration interventions?
   I will monitor responses to targeted restoration interventions for bandicoots.

DYSBIOTIC POUCH MICROBIOME ASSOCIATED WITH POOR DEVELOPMENTAL OUTCOMES IN CAPTIVE BREEDING KOALAS (*PHASCOLARCTOS CINEREUS*)

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Captive Koala breeding programs are essential for long-term species management. However, breeding efficacy at several facilities in South-East Queensland is frequently impacted by high neonatal mortality rates. Loss of pouch young typically occurs during early lactation without prior complications and has a repeat occurrence of 75%. Whilst bacterial infections are often identified during necropsy, host-microbe interactions during Koala development are poorly understood. As such, this study aimed to characterise the Koala pouch microbiome across the reproductive cycle and identify microbial species associated with neonatal mortality. Pouch samples were collected at four reproductive time points from 38 Koalas housed at two breeding facilities. Characterisation of the pouch microbiome was performed using metagenomic sequencing and cultivation, while further characterisation of mortality-associated microorganisms was performed using whole-genome sequencing and *in vitro* diagnostics. Our study identified a distinct microbiome composition associated with neonatal mortality, characterised by sustained dominance of the bacteria *Pluralibacter gergoviae* and *Klebsiella pneumoniae*. *P. gergoviae* isolates recovered following mortality were multi-drug resistant and possessed several virulence factors associated with fatal disease. Overall, our findings conclude that pathogenic microorganisms in the pouch are associated with neonatal mortality in Koalas, and that standardised screening and reporting are vital for improving breeding outcomes.

☺ Student presentation

A PLANT PATHOGEN REDUCES THE HABITAT AND FORAGING ACTIVITIES OF QUENDA

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Digging mammals play key roles in ecosystems, with their bioturbation enhancing ecosystem processes including nutrient cycling, fungal dispersal, and seed retention. The quenda (*Isoodon fusciventer*) is one of the few digging mammal species living outside of protected areas in south-western Australia. However, populations are threatened by habitat degradation and fragmentation. A major cause of vegetation loss in southwest WA is the plant pathogen *Phytophthora cinnamomi*. This pathogen causes significant forest dieback, impacting on availability of fauna habitat.

We investigated how *Phytophthora cinnamomi* infestations impact quenda's habitat and foraging activities. Although pathogen-affected forest is unfavourable for quenda, these bandicoots still use grasstrees (*Xanthorrhoea preissii*) persisting within infestations, as evidenced by quenda tunnels in their downturned 'skirts'. However, quenda-habitable grasstrees used for nesting were 45% fewer ($p = 0.007$) inside pathogen-infested areas, low-shrub plant cover used for shelter was 46% less ($p < 0.001$), and numbers of quenda diggings had decreased by 33% ($p < 0.001$) compared with adjacent unaffected forest.

Phytophthora cinnamomi infestation is widespread, overlapping with the quenda's geographic distribution. Reduced quenda activity as a consequence of this pathogen would result in cascading loss of ecosystem functions, making research and management of *Phytophthora cinnamomi*-mediated habitat degradation a wildlife conservation priority.

☺ Student presentation

ONLINE PRESENTATION

GENOMIC REVIEW OF NATURAL AND TRANSLOCATED NUMBAT (*MYRMECOBIUS FASCIATUS*) POPULATIONS

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Genetic diversity, population structure and translocation 'success' should be assessed as part of routine monitoring, as the data can provide information about long-term population stability and used to optimise conservation outcomes. This is particularly relevant when managing threatened species, like the numbat (*Myrmecobius fasciatus*). In this study, we assessed the genetic 'health' of two natural and three translocated populations of numbats and compared the utility of two types of genetic markers. 18 microsatellites and 4,623 SNP's were generated from 138 individuals. Genetic diversity was assessed using GenAlEx and diveRsity in R. We determined population structure with DAPC (R), estimated population size with NeEstimator and tested for genetic bottlenecks with BOTTLENECK1.2 and GENHET (R). Both markers showed similar trends. Genetic variation was high in all populations, and comparable with other Dasyurids. Both natural populations have similar levels of diversity and clear genetic structure, appearing as two defined clusters. All translocations retain a substantial amount of the diversity of their source population, and we found no evidence of population declines. Overall, numbat populations appear stable, and are not suffering from problems associated with loss of diversity. This study helps guide the ongoing genetic management of this iconic species.

ONLINE PRESENTATION

DIFFERENTIATING RARE BANDICOOTS IN A LATE QUATERNARY CAVE DEPOSIT

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The rapid loss of mammals in Australia over the last 230 years means that reference material of some endangered species is rare in public collections. This poses challenges for researchers working to identify skeletal remains from paleozoological deposits. We present a morphometric approach to differentiating postcrania of two endangered bandicoots in archaeological deposits from Boodie Cave, Barrow Island. Calcanea and ulnae from small-bodied bandicoots such as the Marl and Golden Bandicoot are common in the site, although differentiating their remains is difficult as few postcranial specimens are available for comparison. We tested whether a morphometric comparison of the common peramelemorphia (*Isoodon*, *Perameles* and *Macrotis*) can be used as a proxy test for genus membership of specimens of rare or extinct species. Differences in bone shape were explored between the three genera and discriminant analysis was used to classify unknown archaeological specimens. We found the Golden Bandicoot and Greater Bilby are the most common taxa at Boodie Cave, although small-bodied *Perameles* species are also present in smaller numbers. Morphometrics are a powerful tool for differentiating mammalian postcrania, which are abundant in palaeozoological assemblages and can substantially increase our understanding of taxonomic abundance and diversity in late Quaternary cave deposits.

SPEED TALK

TAXONOMY AND EVOLUTION OF THE COMMON BRUSHTAIL POSSUM *TRICHOSURUS VULPECULA* IN AUSTRALIA

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Accurate species delimitation is a critical and important step when planning conservation management, particularly in Australia where many mammal species are under threat. The phenotypic variation within the common brushtail possum *Trichosurus vulpecula*, as well as their widespread distribution across most of Australia, has resulted in a complicated taxonomic history that has been disputed and revised many times. Several populations have undergone severe declines since European colonisation, therefore resolving the species complex is critical for appropriate protection and management of the declining phenotypes. This study will represent the first time a total evidence approach will be used for this species and will combine comprehensive morphological and molecular data from many localities across Australia, with the aim of resolving the taxonomy and clarifying the biogeography of *T. vulpecula*. Morphological variation across the species range will be assessed by analysing cranial and dental morphometrics, external body measurements, and pelt colour variation from museum specimens across Australia. To determine whether geographically separated populations correspond with genetic differences, a molecular phylogeny will be produced from single nuclear polymorphism (SNP) data. A total evidence analysis will then combine this morphological and molecular data, clarifying species and subspecies boundaries of *T. vulpecula.*

SPEED TALK

KANGAROOS OUTSIDE THE DINGO BARRIER FENCE GROW FASTER THAN THOSE INSIDE

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Australia's dingo barrier fence is the longest environmental barrier in the world. This barrier has a range of effects on the ecology and landscape, with recent calls to decommission the fence. However, to what extent ~ 100 years of predator exclusion might have had on dingo prey demographics and development is unknown. We present results from demographic and morphometric analyses of 166 red kangaroos (*Osphranter rufus*) – a prey species of the dingo – obtained from two adjacent properties separated by the dingo barrier fence. We found no differences in skull shape between the two populations, but the population exposed to dingo predation had proportionally fewer juveniles and females, and grew faster, than the neighbouring dingo-free population. Faster growth rates were represented by larger cranial size, body weight, and pes lengths at younger ages, estimated from molar progression. We discuss whether these results are a product of intrinsic adaptations to contrasting predation pressures across the fence, or environmental factors. Our data represent a 'snapshot' sample which, while not without limitations, could inform future research regarding the impact of the fence on dingo prey species.

MITOCHONDRIAL DNA SUPPORTS EXTINCTION OF A WESTERN QUOLL SUBSPECIES (*DASYURUS GEOFFROII GEOFFROII*) FOLLOWING EUROPEAN ARRIVAL.

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The arrival of Europeans in Australia had a significant and lasting effect on native fauna. Recent molecular and morphological analyses of historical museum specimens and subfossil bones have identified previously unknown extinct species and phylogenetic lineages and have highlighted the scale of lost biodiversity. We generated 42 mitochondrial genomes of the western quoll (*Dasyurus geoffroii*) from extant and extinct populations across southern Australia to examine phylogeography across its historical range. We aimed to test the hypothesis that two subspecies, represented by the morphologically distinct *D. g. geoffroii* and *D. g. fortis*, existed prior to widespread extirpations. We found two monophyletic clades, that diverged prior to the LGM (25-16kya), one that comprises extant populations from Western Australia, while the other comprises samples from extirpated populations in Queensland, New South Wales and the holotype of *D. g. geoffroii*. There appears to be overlap between the two clades in South Australia, particularly on the Nullarbor. These results provide support for two sub-species of the western quoll, one of which is now extinct, and highlight the critical role of historical studies and museum collections in documenting Australia's vanished biodiversity.

USING SUBFOSSILS TO REASSESS THE TAXONOMY OF MULGARAS

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The genus *Dasycercus* has been the subject of taxonomic change for the past few decades. Previous studies have attempted to resolve the taxonomic issues using morphological characters and genetic testing. However, there has been confusion surrounding the results of genetic material tested. The inclusion of subfossil material has also proven difficult, as morphological characters are so variable that it is difficult to identify species based craniodental material. The aims of this investigation are to define dental and cranial morphological characters to identify *Dasycercus* from subfossils, and to determine if undescribed taxa exist within subfossil records. Specimens of *Dasycercus* from across Australia were assessed using traditional cranial morphological measurements and craniodental characters. Measurements were analysed using a Principal Component Analysis, resulting in taxa being arranged by the principal components that most influenced their morphology and grouping them as such. A total of six taxa were found within the genus, including three undescribed taxa. This indicates that *Dasycercus* is far more diverse than originally thought. It is believed that only two of the six taxa are extant, meaning this work represents the first records of dasyurid extinction. This study highlights the importance of incorporating subfossils to resolve the taxonomy of modern taxa.

☺ Student presentation

BIASES IN ESTIMATES OF ANIMAL ABUNDANCE. USING THE SOUTHERN HAIRY-NOSED WOMBAT (*LASIORHINUS LATIFRONS*) AS A MODEL SPECIES

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Reliable estimates of animal abundance underpin species management. Unfortunately, traditional methods of estimating abundance often have different levels of accuracy and bias due to small number of locations with small sample sizes in space and time. Many wildlife surveying methods can only take place in areas with sufficient access, further aggravating bias. The use of spatial technologies has increased in recent decades to overcome these limitations but also has shortcomings.

The Southern hairy-nosed wombat (*Lasiorhinus latifrons*) is an ideal model species to study abundance and the associated spatial and temporal biases of different survey methods. Due to their large size and burrowing habits, they leave obvious traces in the landscape. This presentation contrasts multiple on-ground and spatial methods (field surveying, motion detection cameras, scat counts, spotlighting, satellite, air photos, deep learning).

In conclusion, accurate monitoring of population distribution and abundance needs to include a systematic analysis of spatial and temporal covariates. A combination of methods helps to compensate for methodological biases and combinations of field and spatial methods improve overall accuracy of broad scale population estimates. Or in other words, in the same way that airborne observations require ground truthing, ground observations may benefit from air-truthing.

SHARK BAY MICE ON FAURE ISLAND USE A RANGE OF DIFFERENT HABITAT TYPES

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Shark Bay Mice (or Djoongari, formally *Pseudomys fieldi* but now synonymised with the extinct Gould's Mouse *P. gouldii*) were once widespread across arid Australia. Following European colonisation, SBM declined catastrophically and the only extant population is now found on Bernier Island. Several reintroductions of SBM have been attempted, but populations have successfully established at only two sites, on Faure Island and North West Island. A lack of suitable habitat, particularly dense stands of coastal spinifex (*Spinifex longifolius*), is thought to have contributed to the failure of the species to establish at some sites. We analysed records of SBM on Faure Island from 2002 to 2022 to assess patterns of detection in different habitat types, including coastal spinifex. SBM were frequently detected in all studied habitat types on Faure Island. Preliminary analyses found that SBM were detected in each habitat in line with its availability, indicating that coastal spinifex may not be necessary for the species to persist at all reintroduction sites. Understanding habitat use by SBM on Faure Island may help to inform the selection of future reintroduction sites, particularly in the context of reintroductions to mainland locations within the species' historical range but where coastal spinifex does not occur.

ONLINE PRESENTATION

NEW FOSSILS REVEAL GIANT SHORT-FACED KANGAROOS (STHENURINAE; MACROPODIDAE) RANGED ACROSS THE AUSTRALIAN TROPICS IN THE LATE PLEISTOCENE

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A lot has been said in the past two decades about the fate of the so-called 'megafauna' of Pleistocene Australia. Ideas developed to explain the cause(s) of the extinctions generally centre around the role of humans and climate change. To adequately test such hypotheses, reliable insights about stratigraphic ranges, taxonomy, palaeobiology, palaeoecology, and palaeobiogeography (to name a few), remains critical. However, it is striking how so few data actually exists for the nearly 90 megafaunal species that suffered extinction. Despite the increasingly voluminous literature on Australian megafauna, very few studies have attempted to develop the basic datasets fundamental for the adequate testing of extinction hypotheses. Here I report new fossil specimens of giant short-faced kangaroos (Sthenurinae), a speciose subfamily of large-bodied macropods traditionally considered to be temperate specialists of southern Australia during the Pleistocene. The new specimens (including species of *Sthenurus*, *Simosthenurus*, and *Procoptodon*) were collected from late Pleistocene deposits at Broken River (near Greenvale) and Floraville (near Burketown) of North Queensland and represent species range extensions of up to 2000 km. Apart from fundamentally changing our understanding of sthenurine palaeobiogeography of the Pleistocene, extinction hypotheses now need to consider the loss of short-faced kangaroos from the Australian tropics.

CONSERVATION GENETICS AND POPULATION MODELLING USING HIGH PERFORMANCE COMPUTING: THE REINTRODUCTION OF *PSEUDOMYS GOULDII*

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Translocations face risks including a population's failure to establish, the loss of vital genetic diversity and the overharvest of source populations. Lessons learnt from the translocation history of the djoongari (Shark Bay mouse, *Pseudomys gouldii*) have led to the use of an innovative strategy to promote its successful reintroduction to Dirk Hartog Island. By integrating population genetics into population models run using high performance computing, we compared potential translocation scenarios to optimise management outcomes. Identification of single nucleotide polymorphisms across individuals sampled from three extant populations led to the confirmation of low and weakly structured genetic diversity throughout the species. Analysis of 20 scenarios with varying founder population sizes, sex ratios and harvest ratios from source populations found an optimal scenario to meet criteria for successful establishment without detriment to source populations. The optimal scenario included a minimum founder population of 120 individuals, mostly from Northwest Island, with supplementation of at least 40 individuals from Bernier Island. A female-biased sex ratio was favoured, however, at least an equal number of females was imperative to the viability of the population. Long-term post-release monitoring will determine the efficacy of this strategy in securing wild populations of the djoongari and other threatened species.

DIBBLER DORMITORIES: IMPROVING POST TRANSLOCATION MONITORING SUCCESS OF A SMALL DASYURID USING SOFT RELEASE TECHNIQUES

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Conservation translocations are an important tool in ecological restoration and the recovery of threatened species. However, approval to undertake translocations is contingent on effective post-release monitoring to assess progress against success criteria. This may be challenging if the species in question is not easy to monitor using traditional techniques. The dibbler (Parantechinus apicalis) is one of 13 species ear-marked for translocation to Dirk Hartog Island (DHI) for the purpose of ecological restoration and to date, three releases of captive bred animals have taken place. Traditional monitoring methods (radio-tracking, trapping and lured remote cameras) were implemented for the first two hard-releases, but proved to be ineffective. In order to improve monitoring efficacy, we trialled two new release strategies in the form of soft release pens and nestboxes for the third translocation in order to encourage greater fidelity to the release site. Release sites were monitored with cameras and detections of dibbler increased markedly, from only six detections in the first two years, to detections at 17/18 release points, over a six-month period following the third release. These results show that these novel release methods for dibblers significantly improved monitoring efficacy and we plan to implement them for future releases on DHI. Using adaptive and innovative strategies is an important part of conservation translocations when species monitoring is challenging.

THE RELATIVE ROLE OF DRIFT AND SELECTION IN SHAPING MORPHOLOGICAL DIVERGENCE IN A THREATENED BETTONG

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Divergence in phenotypic traits is facilitated by a combination of natural selection, phenotypic plasticity, and genetic drift, whereby the role of drift is expected to be particularly important in small and isolated populations. As species continue to undergo range reductions and population declines as a result of anthropogenic processes, remnant populations are becoming increasingly fragmented and genetic and phenotypic variability is being lost at an alarming rate. An understanding of local adaptation is essential when managing the long-term viability of populations, but it is often unclear if phenotypic variation reflects divergent adaptation or is an artefact of non-adaptive processes. Here, we assess phenotypic divergence using a combination of traditional and geometric morphometrics of the burrowing bettong (*Bettongia lesueur*) across its extant and extinct range and share preliminary analyses that attempt to distinguish the relative contributions of drift and selection in shaping cranial morphology. We discuss the implications for understanding the evolutionary processes driving morphological divergence in the context of taxonomy and conservation, particularly in the framework of translocations and genetic mixing.

☺ Student presentation

RODENTS, MARSUPIALS AND BATS – OH MY!
COMMUNITY COMPOSITION IN A MAMMAL HOTSPOT

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The Pilbara in Western Australia hosts a variety of mammal species, from widespread rodents to elusive marsupials and threatened bats. With intensive surveying over several decades, we now understand some of the key habitat components important for different species. For example, ghost bats use caves with high humidity, northern quolls occur in rocky outcrops, while sandy inland mice are more widespread. However, a wealth of biodiversity records presents us with the opportunity to go further by harnessing the power of Species Distribution Modelling to understand the environmental drivers shaping species' distributions. By layering these predictions, we explore species richness and community composition, and compare patterns across rodents, marsupials and bats.

We show that marsupials tend to have strong associations for different climate extremes (i.e., high aridity vs. high precipitation). Rodent and bat distributions are less tied to climate, perhaps reflecting their ability to respond quickly to weather events (rodents), and to buffer climatic extremes using microclimate – i.e., roosting in caves (bats). Rodents and marsupials tended to partition themselves across different substrates, specialising in sand, rock, or clay, while geology was particularly important for bats. We highlight areas of high species richness and the implications for conservation in the region.

PATHOLOGY AND ECOLOGY OF 'FRESH WATER SKIN DISEASE': AN EMERGING CLIMATE-DRIVEN THREAT TO COASTAL RESIDENT DOLPHINS IN AUSTRALIA

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From 2005 to 2020, extreme spring flooding events in south-eastern and south-western Australia resulted in mortality events affecting resident coastal bottlenose dolphins. Pathology is characterised by a distinct ulcerative dermatitis known as *freshwater skin disease* (FWSD). Two remarkably similar mortality events enabled creation of a case definition based on gross, histopathologic, and environmental factors. The first, in spring 2007, affected endemic *Tursiops australis* in the Gippsland Lakes, Victoria, while the second, in spring 2009, occurred in *T. aduncus* resident in the Swan-Canning River system, Western Australia. Features common to both were (1) an abrupt and marked decrease in salinity (from >30ppt to <5ppt) due to catchment rainfall, with hypo-salinity persisting weeks to months, and (2) a striking and characteristic ulcerative dermatitis covering up to 70% of the body surface, with correlatory histopathologic features. Thus, the environmental factors (natural or anthropogenic) and characteristic pathologic lesions, are necessary components of the case definition for FWSD. Recently (2019 and 2020), FWSD outbreaks in the northern Gulf of Mexico and south-eastern Australia have killed hundreds of coastal *Tursiops* sp. making this seasonally recurrent ulcerative dermatitis one of the most significant emerging threats to coastal dolphins, both in Australia, and globally.

DISTRIBUTION, ABUNDANCE AND DISEASE STATUS OF SOUTHERN HAIRY-NOSED WOMBATS IN ADJACENT AREAS OF CROPPING AND NATIVE VEGETATION ON THE SOUTHERN YORKE PENINSULA, SOUTH AUSTRALIA

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Approximately 98% of the Southern hairy-nosed wombat (SHW) distribution occurs on arable land. This puts the species in direct conflict with farmers, particularly associated with the consumption of crops, and the construction of burrows within cropping paddocks. Both of these factors can result in significant financial and labour costs to producers. To assess differences in SHW population characteristics associated with land use, data was collected on warren distribution and abundance at Point Pearce, Yorke Peninsula, SA. Burrows were also assessed for activity. The relative abundance of SHW with land use were estimated using remote camera monitoring of burrows. A subset of animals was caught and assessed for mange from skin scrapings. In total 1,437 warrens were identified across the Pt Pearce site, comprising ~6,300 burrows. Approximately 690 warrens were in cropping paddocks, of which 86% were active, compared to 74% in adjacent scrubland. Wombats per active burrow and overall wombat abundance in cropland, was double that of adjacent scrubland. No mange was detected in forty animals caught and assessed. There is an apparent significant wombat problem within the land currently designated for cropping. As the SHW is an iconic and much-loved species managing litigation problems of over-abundance is fraught with difficulty.

PREDATOR ESCAPE BEHAVIOUR IN THREATENED MARSUPIALS

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Introduced predators are an ongoing problem facing Australian marsupials within the 'critical weight range' (CWR; 35g–5.5kg). We quantified the escape behaviour of eight CWR taxa to determine if differences in how they escape from predators could provide insight to their vulnerability. We predicted that behaviour would be phylogenetically-linked, where related species with similar morphology perform similar escape tactics. Animals were filmed escaping through a runway and 20 measures relating to their gait, speed and path characteristics were recorded. Multidimensional scaling produced four dimensions: (1) linear speed versus agility, (2) acceleration style, (3) hesitancy to react and (4) gait characteristics. We found a strong link between phylogenetic relatedness of species and their use of linear speed or agility when fleeing (phylogenetic heritability, h^2=0.96). Bipedal macropod species were more reactive and used straight-line, fast escapes, which may be suited to evading ambush/stalking as well as pounce-pursuit predators. The quadrupedal bandicoots had an overall slower escape but were more likely to use sudden changes of direction, which can be successful if pursued by larger, less mobile predators or where there is sufficient vegetation to obstruct pursuit. Our research suggests that morphology can reflect escape performance and may have implications for extinction risk.

☺ Student presentation

ARBOREAL MAMMAL DISTRIBUTION, ABUNDANCE AND DIVERSITY IN ROADSIDES OF THE STRATHBOGIE RANGES, VICTORIA

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Modified linear habitats, such as roadsides, can complement larger habitat patches and are critically important for biodiversity and off-reserve conservation. We spotlight surveyed 30 stratified, randomly selected 500 m roadsides, throughout the Strathbogie Ranges in northeast Victoria, Australia, to determine the distribution, relative abundance, and diversity of six native arboreal mammal species, and identify site- and landscape-level factors influencing these species among roadsides. We found that arboreal mammals were common and abundant throughout roadsides (range of mean species abundance at sites 3.6-16), including koalas, bobucks and common brushtail possums, Krefft's gliders, and common ringtail possums. Threatened southern greater gliders were much less common than we anticipated, present at only 13% (4/30) of sites. The relative abundance of species at the site-level was influenced by habitat preferences and resource availability. Notably, species abundance and diversity were generally greater at roadsides with less surrounding forest cover, suggesting mammals are reliant upon high-quality habitat within roadsides. Furthermore, *Acacia* and symphyomyrtle eucalypt abundance in roadsides were associated with increased species diversity. Our study demonstrates the significant biodiversity values of roadside vegetation for arboreal mammal conservation, and hence, we recommend they are protected and managed as part of integrated on- and off-reserve wildlife conservation.

NEW SPECIES OF BANDICOOT IN THE GENUS *PERORYCTES* (MARSUPIALIA: PERAMELEMORPHIA) FROM KWIYAWAGI, IRIAN JAYA, INDONESIA

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New Guinea and surrounding islands have a large diversity of peramelemorphians. A new species of *Peroryctes* is described here from the high elevation West Baliem River valley Papua Province, Indonesia. Both morphometric analyses and morphological phylogeny clearly separate the new taxon from the two known species, *Peroryctes raffrayana* and *Peroryctes broadbenti.* Our attempt to recover molecular data from the type specimen recovered poor quality sequences, which we couldn't analyse. As a result, the new species is established based on morphological data alone. The new species is rare and very likely to be endangered.

CONSERVATION IN THE CITY: THE IMPORTANCE OF RESIDENTIAL GARDENS FOR MAMMAL WILDLIFE

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As natural areas continue to disappear globally, there is a growing necessity to consider the role of novel ecosystems such as urban landscapes in biodiversity conservation. Although residential gardens collectively comprise a major component of the total urban greenspace and a wide-range of taxa occur in these areas, their value for wildlife conservation and how they could be harnessed to achieve conservation outcomes remains poorly understood. We examined four research questions to evaluate the value of gardens for mammal conservation: (1) how widespread are species within residential landscapes, (2) what assemblage of wildlife can be supported by gardens compared to urban remnants, (3) which factors promote the use of gardens by wildlife, and (4) can species reside within gardens. Using a combination of online questionnaires, an extensive seasonal field program (trapping, spotlighting, acoustic surveys) and radio-telemetry, our research demonstrated that some mammals can be widespread within residential landscapes, the diversity and abundance of mammals in gardens can be comparable to in urban remnants, and some species can reside exclusively within residential landscapes for several months of their life. The findings from this research provide promise that gardens are valuable for conservation and should be considered in management initiatives.

POPULATION GENOMICS AND CONSERVATION MANAGEMENT OF RODENTS AND QUOLLS IN NORTHERN AUSTRALIA

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Genetic diversity is a fundamental component of the Earth's total biodiversity, and to conserve this diversity, we need to measure its spatial distribution and quantify the contribution that any intraspecific evolutionary lineages make. Over the past few years, we have used next-generation sequencing to describe the range-wide population genetic structure of, and patterns of population decline in, the black-footed tree-rat (*Mesembriomys gouldii*), the brush-tailed rabbit-rat (*Conilurus penicillatus*), and the northern quoll (*Dasyurus hallucatus*). In all species, we found strong population structuring, with high levels of differentiation among broad geographic regions and between mainland and island populations. We also found that the effective population size of many populations has been declining over much of the past century, with declines in northern quolls exacerbated by the range expansion of the introduced and lethally toxic cane toad. We conclude that (1) biogeographic barriers separate sub-regions each containing substantial amounts of unique genomic diversity, (2) remnant island populations harbour only a subset of the diversity present within each sub-region, (3) large insurance populations on islands or in fenced safe havens can maintain high levels of genomic diversity, and (4) contemporary declines play out against broader declines resulting from various threatening processes.

FELIXER GROOMING TRAP TRIAL: FERAL CAT CONTROL FOR CONSERVATION IN THE SOUTHERN FORESTS, WESTERN AUSTRALIA

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Feral cats are one of the most significant threats to native terrestrial vertebrate species in Australia. The objective of our trials is to determine the most effective methods for deploying Felixer™ grooming traps in the southern jarrah forest of Western Australia. We deployed eight Felixer traps over three, 14,000 ha sites for 2-3 months each. Cat individuals and activity before, during and after the deployment of the traps was monitored by an array of at least 50 remote cameras. Preliminary results indicate that feral cat activity in these areas reduced by 49%, 31% and 78% at the three trials sites, relative to comparative control sites. The reduction of feral cat activity at the treatment site was sustained for up to five months after the Felixer™ traps were removed. The Felixer™ traps are safe to use in the presence of native fauna in the area. Early indications are that these traps may be able to remove more than 60% of the cat individuals present at a meso-spatial scale, and therefore be an important and complementary tool to deliver improved conservation outcomes for threatened species vulnerable to cat and fox predation in the jarrah forest.

POPULATION CHARACTERISTICS AND GENETIC HEALTH OF THE SEMI-ARID ADAPTED YELLOW-FOOTED ROCK-WALLABY (*PETROGALE XANTHOPUS XANTHOPUS*) AT AROONA DAM SANCTUARY, 23 YEARS AFTER REINTRODUCTION

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Population characteristics and genetic diversity of yellow-footed rock-wallabies (*Petrogale xanthopus xanthopus*; YFRW) was examined 23 years after reintroduction at Aroona Dam Sanctuary, Flinders Ranges, South Australia. Information on population size, genetic health, and diet was gained using DNA from faecal samples (scats). Euro and feral goat scats were also used for dietary comparisons. Faecal DNA trials indicated that degradation was rapid (<7 days), hence only scats less than 7 days old were used in the main project. Scats were collected across approximately 1km^2 on the north-east facing slopes of Mount Aroona, adjacent to Aroona Dam. DNA profiling indicated that the current YFRW population consists of a minimum of 15 animals (6 males and 9 females) with an observed heterozygosity (H_o) of 0.220 ± 0.042 and an allelic diversity of 2.8 ± 0.28. Colony genetic parameters were relatively poor, but comparable to those of other YFRW populations in the Flinders Ranges. The diet of euros and feral goats overlapped significantly with that of the YFRWs at Aroona Dam in spring and autumn. Although few animals (N=12) were initially reintroduced, the colony persists and remains viable. Ongoing landscape-scale fox and goat control will underpin this YFRW population's survival, growth and longevity.

REFUGES FOR CONSERVING THREATENED SMALL MAMMALS IN THE OTWAY RANGES

Barbara A. Wilson [1,2,3], Mark J. Garkaklis [1,2,3], J. White [1] & K. Agosta [1]

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There is growing evidence that regional persistence of threatened mammals is often reliant on the presence of refuges that provide beneficial environments, high resources and protection from disturbances such as fire, predation, water stress. It is important to understand the characteristics of refuges and where they occur in the landscape. While severe small mammal declines have been recorded in the eastern Otways over the last decade, there is evidence that coastal dunes and gullies are providing refuges. Camera and live trapping studies (2019 -2022) have been employed to identify key refuges across the landscape. Coastal dunes extending from the eastern to western Otways have been identified together with an extensive inland refuge, the Carlisle Heath. Threatened species recorded include Southern Brown bandicoot, Long-nosed Potoroo, Swamp antechinus, Broad-toothed rat together with other species and healthy communities. Coastal dunes are characterised by dense, structurally complex vegetation, absence of fire and high nutrients, however they are small and fragmented. Carlisle Heath has dense, structurally complex vegetation, particularly in Wet Heathy Woodland, high vegetation productivity and medium to long post-fire intervals. Cost-effective management is required for protection of refuges including predator control, safeguard from habitat fragmentation and inappropriate fire regimes.

CROSS-CULTURAL COLLABORATION LEADS TO IMPROVED UNDERSTANDING OF THE RARE SPECTACLED HARE-WALLABY IN THE WEST KIMBERLEY

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Cross-cultural collaboration between Yawuru Country Managers (Rangers) and WWF-Australia ecologists led to a rediscovery of the spectacled hare-wallaby (SHW, *Lagorchestes conspicillatus*) in the west Kimberley region of WA where it was presumed to be locally extinct. This collaboration relied on the expertise of the Rangers to select locations for targeted field surveys, resulting in confirmation of SHW on the Yawuru IPA for the first time in a decade. Subsequent remote camera trap surveys found a negative relationship between SHW occurrence and distance to fire scar edge. During our 2022 survey, SHW activity was investigated on this edge habitat. It showed SHW were more active in recently burnt areas during the night when foraging and in denser longer unburnt areas during dawn and dusk when searching for or emerging from daytime shelter. These findings support fire management using small, patchy, cool mosaic burns in the early dry season to promote optimal habitat for SHW. This project highlights the benefits of cross-cultural research and monitoring partnerships with Indigenous rangers as active observers and managers of their traditional lands.

ONLINE PRESENTATION

PROBLEM SOLVING IN WILD ANIMALS IN THE WET TROPICS OF QUEENSLAND

M. K. Rowell & T. L. Rymer

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While many species of animals have been found to solve food-baited problems, most studies are conducted in captivity, which may not reflect the natural behavioural and cognitive abilities of wild animals. Furthermore, very little work has been done using Australian animals. We therefore investigated the problem solving abilities of native Australian species in natural rainforest in the Wet Tropics of Queensland. We baited multiple types of puzzles (matchbox task, cylinder task, and tile and lever tasks on the Trixie Dog Activity Board) with different food types (seeds, fruit, sardines) and placed the puzzles in front of trail cameras. We found that native Australian species from multiple taxa (mammals, birds, reptiles) could solve food-baited problems in the wild, which was the first evidence of problem solving in 7 native species. As problem solving can help animals cope with anthropogenic threats, these results provide some insights into which Wet Tropics species may potentially be more vulnerable and which ones might be better at coping with changing conditions.

ONLINE PRESENTATION

FAT-TAILED DUNNARTS OF THE VICTORIAN GRASSLANDS: VULNERABLE TO EXTINCTION

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Fat-tailed Dunnarts (FTDs) occur across Australia and are found in a variety of habitats. However, the FTDs of Victoria are geographically isolated and are genetically distinct. In Victoria, this species occurs in grasslands, grassy woodlands and shrublands. Grasslands once covered 30% of the state, but there is now <1% of the original habitat remaining. As 55% of Victoria is freehold agricultural land, most of this species' populations persists on privately owned farmland. FTDs can survive in degraded landscapes, but they rely on basalt rocks or soil cracks for shelter which are not maintained in cropped landscapes. Between 1985 and 2019, there have been increases of 21 to 488% in the number of hectares under dryland cropping across Victoria (dependent on Catchment Management Authority region), as farmers are forced to accommodate changing climate. This threatens what little remains of appropriate habitat for FTDs and has likely contributed to population declines and local extirpation. Due to ongoing population declines the FTD has recently gained Scientific Advisory Committee support for the nomination as Vulnerable in Victoria under the Flora and Fauna Guarantee Act, against IUCN criteria. We hope this will assist conservation of the last remaining small mammal of our grasslands.

☺ Student presentation

ONLINE PRESENTATION

FAECAL ANALYSIS FOR A BETTER FUTURE: PROGESTERONE METABOLITE MONITORING AS A MANAGEMENT TOOL FOR BREEDING KOALAS IN CAPTIVITY

Jade Seaton ☺, Tamara Keeley & Steve Johnston

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Within the project 'A Living Koala Genome Bank', wild koalas temporarily brought into captivity were co-housed, intending to produce offspring for release back into wild habitats; conversely, wild males were co-housed with captive females to produce genetically valuable offspring, thus enhancing the captive population. This study aimed to identify a significant increase in faecal progesterone metabolites in female koalas post-mating to indicate ovulation. Faecal samples were collected daily from captive females from the day of known mating; comparatively, faecal samples were collected 3-4 times per week from wild females co-housed with males. Faecal samples were dried overnight at ~65°C, weighed to ~0.2g and extracted using 5ml 80% methanol for analysis via progesterone enzyme-immunoassay. Results of analyses confirmed a rise above baseline faecal progesterone metabolite concentrations within 3 days of mating for all captive females (n = 6), with 100% parturition success rate post-ovulation. Analysis of wild females (n = 8) confirmed sustained elevations in faecal progesterone metabolite concentrations indicative of luteal phase or pregnancy a total of 14 times, with 21% breeding success rate post-ovulation. Utilising non-invasive hormone monitoring techniques allowed for a hands-off approach to breeding procedures, and the evaluation of ovulation rates versus successful production of young.

☺ Student presentation

ONLINE PRESENTATION

THE VULNERABILITY OF THE HOPPING MOUSE (*NOTOMYS)* OF AUSTRALIA: INTEGRATING DATA FROM PALAEONTOLOGY WITH MODERN CONSERVATION

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The Australian hopping mice, *Notomys*, include ten species, eight of which are considered either extinct or endangered. Here, we report a new fossil species from the Broken River Region, northeastern Queensland. *Notomys* sp. nov. is represented by craniodental material from cave deposits in the region dating from the middle Pleistocene to Holocene (ca. 350 ka – 8 ka). Its youngest fossil record is therefore geologically recent, and it is likely that the species persisted thereafter. The Holocene record of *Notomys* sp. nov. rules it out as a victim of Late Pleistocene extinctions alongside the 'megafauna' but raises questions about the diversity and severity of historical losses of hopping mice. It is possible for *Notomys* sp. nov. to have been extant at the time of European colonization but suffered extinction thereafter, mirroring the fate of other arid-adapted taxa with which it co-occurs, including the Northern Pig-Footed Bandicoot (*Chaeropus yirratji*) and Long-Tailed Hopping Mouse (*Notomys longicaudatus*). Additional sampling of geologically recent fossils as well as surface deposits from the region would be necessary to test that hypothesis.

☺ Student presentation

SPEED TALK

PATTERN RECOGNITION SOFTWARE TO IDENTIFY UNIQUELY MARKED INDIVIDUALS

Melissa Taylor [1]☺, Kate Bryant [1,2], Mike Calver [1], Adrian Wayne [3] & Nicole Armstrong [4]

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Camera traps are an invaluable tool to gather data on wildlife, including the opportunity for individual IDs when animals have unique markings. This can be a long, arduous process, prompting the development of software to expedite processing. One freeware program, named I3S Spot, uses manually input spots and metadata to run pattern recognition against previously identified images. Through my PhD I have used this program to identify individual Chuditch (*Dasyurus geoffroii*) caught on camera traps with a high degree of success and confidence. I3S Spot also shows promise in recognising individuals from juvenile to adult life stages.

☺ Student presentation

SPEED TALK

SMALL WONDERS: TWO NEW SPECIES OF TINY MARSUPIALS

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The world's smallest marsupials are found in the genus *Planigale* and currently five species are recognised, though multiple molecular studies suggest this is an underestimate of the true species diversity within this genus. Here we introduce two new *Planigale* species, both from the Pilbara region of Western Australia, previously recognised as either *P. maculata* or *P. ingrami*. We will detail how these new species differ and discuss relevant aspects of their morphology, life-history and habitats.

SPEED TALK

ASSESSING THE USE OF CHAINSAW HOLLOWS BY WILDLIFE ACROSS FIRE-AFFECTED EAST GIPPSLAND, VICTORIA

Nathan Waddell [1], Anthony R. Rendall [1], Joanne L. Isaac [2], Susannah Hale [2] & Euan G. Ritchie [1]

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Tree hollows are vital for the survival and reproduction of many Australian wildlife species, and hence their preservation is critical for preventing further species declines and extinctions. Logging, land-clearing, urbanisation, and fire have resulted in widespread hollow destruction.

Chainsaw hollows are artificial cavities mechanically carved into tree trunks or branches using power tools. Chainsaw hollows show promise as a form of habitat supplementation, however, to date little ongoing monitoring has been performed on chainsaw hollows and factors affecting occupancy rates of wildlife species across large regions of Australia.

Our study set out to determine the occupancy rates of wildlife using chainsaw hollows in East Gippsland, Victoria, and to determine what factors of chainsaw hollowbearing trees and surrounding environmental features influenced occupancy rates by wildlife. We monitored 111 chainsaw hollows which were installed five to fourteen months prior to surveying. We performed three repeat observations of hollow occupancy via pole camera and assessed vegetation characteristics in the vicinity of chainsaw hollows. Of the 81 smaller hollows, 33% showed signs of wildlife occupancy, with confirmed use by three species. The entrance height of chainsaw hollows and internal volumes were found to positively influence occupancy by wildlife.

Alphabetical list of POSTER abstracts (by presenting author)

POSTER

AUSTRALIAN MAMMALOGY AND OTHER CSIRO PUBLISHING JOURNALS

Calver, Michael

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The Australian Mammal Society's journal *Australian Mammalogy* is published by CSIRO Publishing, along with several other journals relevant to mammalogists: *Wildlife Research*, *Australian Journal of Zoology*, *Pacific Conservation Biology*, *Marine and Freshwater Research*, *The Rangeland Journal*, and *Reproduction*, *Fertility and Development*. If you are curious about the metrics for any of these journals, have feedback for the publisher or the editorial boards, want to discuss options for Special Issues or Open Access, or have other questions relating to CSIRO Publishing journals, please stop at this poster to chat with Michael. As Editor in Chief of one of the CSIRO journals he may be able to answer your questions on the spot, or if not he will know the right contact.

POSTER

PRESENTATION OF BABESIOSIS IN EASTERN GREY KANGAROO JOEYS (*MACROPUS GIGANTEUS*)

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More than 29 Eastern Grey Kangaroo Joeys (Macropus giganteus) have been recorded with guarded prognosis of Babesiosis. This is a study of the cumulated data of 29 joeys of various sizes and ages that were rescued by Wildlife Rescue South Coast over a 3-year period. The animals' clinical vitals (respiration rate, heart rate and temperature) were taken upon arrival as well as blood for both PCV testing and blood smears. Presentations of pale gingiva and conjunctiva, swelling, lethargy and appetite were observed over the triage process and time in care. Fifty-five percent of the kangaroos experienced both tachycardia and tachypnoea, 45% had hypothermia upon arrival with 20% in hyperthermic ranges and 35% in normal ranges. All animals exhibited haemolytic anaemia in their blood smears and packed cell volume of under 40%. The histories of these animals have had unknown effects on the results with capture myopathy, environmental factors and age being taken into consideration while studying the data. It is recommended that more research needs to be taken to have more definitive clinical signs and symptoms of Babesiosis in Eastern Grey Kangaroos and other marsupials.

☺ Student presentation

POSTER

POPULATION GENETICS OF WILD RED-TAILED PHASCOGALES IN SOUTH-WEST WESTERN AUSTRALIA

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The red-tailed phascogale, *Phascogale calura*, is listed as conservation-dependent, yet we know very little about its genetic health. Due to their highly fragmented and restricted habitat in south-west WA, understanding their genetics is crucial to take informed conservation action. This study aims to provide genetic management recommendations by assessing the genetic diversity of the remaining wild populations, and to determine if a previous wild-to-wild translocation to Kojonup reserve is genetically representative of the diversity of the source populations. Samples were collected from 14 wild populations and sequenced using DArTseq. A total of 171 samples were successfully genotyped, with a set of 2,674 SNP markers used. Observed individual autosomal heterozygosity across all reserves ranged from 0.001 to 0.003, and F_{ST} ranged from 0.023 to 0.104. Most within-reserve estimates of relatedness were very low, but several reserves had many highly related individuals. The translocated Kojonup population genetically represents all source populations, but disproportionally so. Overall, populations are not highly distinguishable from each other, although there is some indication of fine-scale genetic structuring, which is best explained by isolation-by-distance. To maximise diversity, future genetic management should aim to represent many populations in each location and minimise the movement of related individuals between reserves.

POSTER

MORPHOLOGICAL AND GENETIC DIFFERENTIATION BETWEEN POPULATIONS OF RUFOUS HARE-WALLABY (*LAGORCHESTES HIRSUTUS*)

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The Rufus Hare-wallaby (*Lagorchestes hirsutus*) is a small macropod native to Australia which was once highly abundant across the mainland. Since European arrival they have undergone substantial range contractions and today, they are found naturally on only 2 Islands off the coast of Western Australia, Bernier Island and Dorre Island, a population in the Tanami Desert and within multiple translocated populations. The island populations Bernier and Dorre were recognised as two separate subspecies (*L. h. bernier* and *L. h. dorreae*) however they have been synonymised into one subspecies (L. h. bernier). An extinct south-west population *(L. h. hirsutus*) is considered morphologically distinct from both the island populations and to the remanent central population, which leaves this central desert population a potential new subspecies. The aim of this study is to reassess the status of subspecies and to make conservation recommendations based on taxonomic reassessment. With exon capture data available for 1000 – 1500 exons we will be looking at genetic distance methods in R. We will also be analysing skulls and skins measurements, using tests such as PCA, DFA and MANOVA. Our results will provide an understanding of the morphologic and genetic differentiation between populations of *Lagorchestes hirsutus* so the subspecies status can be reassessed.

POSTER

WHAT DID THE MARSUPIAL TAPIR EAT? RECONSTRUCTING THE PALAEOBIOLOGY OF *PALORCHESTES PARVUS*, A BIZARRE EXTINCT GIANT FROM SOUTHEAST QUEENSLAND

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Palaeoecological studies of extinct fauna can provide valuable insights for modern species and ecosystems, but to be effective these must be based on robust palaeobiological data. Such data is limited for even the most well-known and recently extinct Australian mammal taxa, including the extinct 'megafauna'. Here, we apply a range of quantitative methods to investigate the diversity and dietary habits of the Pliocene (ca. 3 million year old) "marsupial tapir" (*Palorchestes parvus)*, a morphologically bizarre member of Australia's marsupial megafauna which has previously been reconstructed as a highly derived forest-browsing specialist. We tested this hypothesis by employing a multiproxy combination of tooth-wear studies (mesowear and 3D microwear), stable isotope geochemistry ($\delta^{13}C$ and $\delta^{18}O$), and anatomical analysis of fossils collected from the Darling Downs, southeast Queensland. Our results suggest that *P. parvus* was not a closed-forest specialist, but rather a generalised herbivore which opportunistically consumed a broad range of plant resources including leafy browse, fruits, roots, and C4 grasses. Our study provides detailed and novel insights into this charismatic megafauna group, and highlights the need for both additional fossil collection and robust, high-resolution, quantitative palaeobiological studies to inform future understandings of extinct Australian taxa.

POSTER

GENETIC DIVERSITY ASSESSMENT OF THE SILVER-HEADED ANTECHINUS

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Conservation genetics is an important research tool in the management of Australian wildlife species, as the impacts of climate change and habitat loss threaten endemic populations across Australia. The silver-headed Antechinus (*Antechinus argentus)* is an Australian marsupial found in naturally isolated populations within sky island rainforest regions across south-east Queensland. The isolated nature of these populations makes them prone to higher levels of inbreeding, with concerns around the possible decreasing of their genetic diversity. We investigated the genetic structure of the three *A. argentus* populations with the aim of recommending appropriate conservation management strategies based on their levels of inbreeding and genetic diversity. We analysed SNP data to determine the population structure across the 3 populations at Kroombit, Blackdown Tableland and Bulburin National Parks, with genetic structure assessment suggesting that the Kroombit and Blackdown populations had a similarly low genetic diversity, while Blackdown had higher levels of inbreeding, whilst the Bulburin population had higher levels of genetic diversity. For *A. argentus,* we suggest that conservation management plans model the impact of translocating individuals between the three populations in order to increase the genetic diversity within populations and prevent higher levels of inbreeding. Overall, our results highlight the importance of understanding the genetic structure of isolated populations when providing conservation advice.

POSTER

EDNA REVEALS THE DIETS OF CRYPTIC, THREATENED MAMMALS ON AN ISLAND TRANSLOCATION

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Assisted colonisation is becoming increasingly considered as a viable conservation tool in response to changing environmental conditions. This strategy has been criticised for the risk of unknown consequences when introducing species outside their historical ranges. In Australia, the prevalence of introduced predators and habitat loss prevents many medium-sized mammals from being reintroduced to their former ranges. Dirk Hartog Island, a former pastoral lease and now predator-free reserve, is host to a number of reintroduced and translocated species. The banded hare-wallaby (Lagostrophus fasciatus) and rufous hare-wallaby (Lagorchestes hirsutus bernieri) have been translocated to Dirk Hartog Island from the nearby Bernier and Dorre Islands. These two species are cryptic in their habits, preventing observational studies of diet. However, it is imperative to understand competition in their new range, and whether either species has increased their dietary breadth in response to more diverse flora. We used non-invasive sampling and next-generation DNA sequencing techniques to compare the diets of these two translocated species in comparison with their original source populations.

POSTER

LANDSCAPE GENETICS OF EASTERN GREY KANGAROOS; DEFINING RESISTANCE AS A TOOL FOR EFFECTIVE CONSERVATION MANAGEMENT

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Eastern grey kangaroo (*Macropus giganteus*) populations within the Sunshine Coast Region (SCR) have undergone rapid decline (~40%). The impacts of the historical and ongoing expansion of urbanisation within the region have prompted the local government to develop strategies to facilitate animal dispersal through a fragmented landscape. This research aimed to determine the landscape variables that either impede or facilitate geneflow between kangaroo populations and identify priority movement pathways to guide conservation management.

Scat samples from 12 populations were sequenced using a targeted genetic probe (DArTag), with data analysed to produce a dissimilarity matrix (F_{st}), revealing significant levels of low-moderate inter-population genetic differentiation. Nine landscape variables were tested that addressed the unique blend of urban, peri-urban and rural landscape characteristics of the greater SCR. Using multivariate mixed-effect modelling and circuit theory, we quantified the landscape variables influence on these populations' genetic differentiation.

We found that canopy height models and major waterways were more influential than the geographic distance to genetic structure. Distance to urban structures and roads were also significant contributors to the structuring. This research is being used by the local government to preserve, create, and manage kangaroo priority habitats and pathways.

POSTER

THE GENETIC AND MORPHOLOGICAL VARIATION WITHIN *SMINTHOPSIS VIRGINIAE* (RED-CHEEKED DUNNART)

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The Red-cheeked dunnart (*Sminthopsis virginiae*) occurs in northern Australia and New Guinea and currently has three subspecies: *S. v. virginiae*, *S. v. nitela*, and *S. v. rufigenis*. Previous molecular studies have indicated the subspecies definitions are incongruent with the genetic variation found within the species. We aim to test the subspecies boundaries within *S. virginiae* using a combined molecular and morphological approach utilising samples from across the species distribution. This is of particular importance for the conservation and management of the Red-cheeked dunnart populations in northern Australia due to ongoing declines in mammal abundance in this area.

We have generated new mitochondrial and nuclear sequence data and tested for differences between the subspecies using phylogenetic tree and haplotype network analyses. The morphological variation within the species has been examined in wet and dry museum specimens, through measurements taken on cranial and external features. Preliminary results suggest the WA and NT populations are more closely related than those from Qld and New Guinea. The implications of our results on the conservation management of *S. virginiae* will be discussed.

☺ Student presentation

POSTER

ON-GROUND RECOVERY ACTIONS FOR SOUTH COAST THREATENED MAMMALS

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The south coast of WA is home to several threatened mammal species. Addressing the threats to their persistence is key to ensuring their ongoing survival.

Through the Australian Government's Regional Land Partnerships Program, South Coast NRM is delivering a number of on-ground recovery actions to benefit EPBC-listed threatened species of the region, including three mammals: Gilbert's potoroo, western ringtail possum, and chuditch.

On-ground actions include revegetation, protection of remnant vegetation by livestock exclusion fencing, invasive predator control, weed control and translocations. Fauna monitoring conducted by South Coast NRM or in partnership with the Department of Biodiversity, Conservation and Attractions provides data to help evaluate the impact of these actions. South Coast NRM also invests in raising public awareness of these threatened species and the need to protect them

Over three years of monitoring, there have been no improvements, nor declines, compared to our baseline data, suggesting a stable trajectory for our target mammals.

We highlight the importance of on-going investment in recovery actions for threatened mammals on the south coast and beyond.

On-ground actions for threatened species must be continued and expanded to achieve improved trajectories for threatened mammal populations on the south coast.

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