



THE UNIVERSITY OF  
**WESTERN**  
AUSTRALIA

# Student Research Projects 2020

School of Biological Sciences



# WELCOME

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As biologists, we are passionate about how living organisms – plants and animals – live, work, sense the world around them, communicate, reproduce, and can be managed, conserved and restored in threatened environments, as well as how they provide clues to advance medical science and treatment. We are also committed to the communication of science to the public and external stakeholders.

Our researchers tackle grand challenges in the laboratory and at field sites across the globe, studying plants and animals in natural as well as managed environments, including below and on the ground and in the air as well as in fresh and marine waters. We use a wide range of techniques spanning scales from molecular and genetic to individuals as well as to populations and higher order ecosystems.

## **Ecology & Conservation**

We research how animals and plants interact with other species and with their physical environment. This fundamental ecological understanding is required to conserve endangered species and protect their habitats with effective, evidence-based methods. Our research takes us to habitats from suburban backyards to deserts and the depths of the sea.

## **Evolutionary Biology**

Our research explores evolutionary responses to selection at the phenotypic and genomic level, with the broad aim of discovering how organisms adapt to their changing environment. CEB takes a multidisciplinary approach to explore selective processes acting on the morphological and life-history traits of whole organisms and their gametes. We have particular expertise in acoustic signalling, predator-prey interactions, visual ecology, sperm competition, chemical ecology, and the genetic mapping of complex traits.

## **Science Communication**

Science communicators bridge the gap between those researching and working in Science Technology Engineering and Maths (STEM) and the public. Science communicators work with researchers, scientists, technologists, engineers, mathematicians, medical professionals, business and industry, policy-makers and members of the public to engage different communities in discussion about important scientific issues, to enhance understanding and help us all make better decisions about our future priorities

## **Neuroscience and Neuroecology**

Comparative neurobiology and neuroecology aims to decipher how different species perceive and process sensory input from the natural world, under different environmental conditions. Our high quality research attracts the next generation of young scientists interested in animal behaviour, sensory processing and the conservation of biodiversity.

## **Computational Biology**

We address fundamental and applied questions in biology using methods and tools from mathematics, statistics and computer science. Using methods such as computational simulation modelling, bioinformatics and big data algorithms we investigate a range of issues including the evolution of resistance to biocides in weeds, coral and seagrass growth patterns and the maintenance of diversity in ecological communities.

**Many projects are available across more than one Honours/Masters Stream/Specialisation.**

**The Marine Science Projects can be found at:**

<https://www.uwa.edu.au/science/-/media/Faculties/Science/Docs/Marine-Student-Research-Projects-2020.pdf>

**Students are encouraged to contact prospective supervisors directly to discuss the project and find out about additional projects not currently listed in this booklet.**



# WELCOME

Welcome to the School of Biological Sciences. With this booklet, we would like to extend a warm welcome to you and introduce our School.

This booklet is designed to provide you with the information about the school & staff, facilities, procedures and resources. Please read through the booklet thoroughly to familiarise yourself with the school. Please also see enclosed Coordinator profiles.

## Meet our Team

| TITLE                           | NAME  | EXT                          | EMAIL  | BUILDING   |
|---------------------------------|---|------------------------------|--|--|
| Head of School                  | Gary Kendrick   | 3998                         | <a href="mailto:gary.kendrick@uwa.edu.au">gary.kendrick@uwa.edu.au</a>   | Zoology L1   |
| Deputy Head of School           | Pauline Grierson  | 7926                         | <a href="mailto:Pauline.grierson@uwa.edu.au">Pauline.grierson@uwa.edu.au</a>   | Botany L1  |
| Academic Services Team Leader   | Pandy Du Preez  | 3863                         | <a href="mailto:lead-acserv-sbs@uwa.edu.au">lead-acserv-sbs@uwa.edu.au</a>   | Zoology L1   |
| Admin / Reception ZOOLOGY       | Jax Ford  | 2206                         | <a href="mailto:admin-sbs@uwa.edu.au">admin-sbs@uwa.edu.au</a>   | Zoology G  |
| Admin / Reception BOTANY        | Pauline Yeung   | 2545                         | <a href="mailto:admin-sbs@uwa.edu.au">admin-sbs@uwa.edu.au</a>   | Botany G Reception                                     |
| Honours & Masters Support       | Christine Riordan   | 3535                         | <a href="mailto:projects-sbs@uwa.edu.au">projects-sbs@uwa.edu.au</a>   | Zoology L1   |
| Plant Growth Facility           | Rob Creasy<br>Bill Piasini                                  | 8549<br>4758                 | <a href="mailto:robert.creasy@uwa.edu.au">robert.creasy@uwa.edu.au</a><br><a href="mailto:bill.piasini@uwa.edu.au">bill.piasini@uwa.edu.au</a>   | PGF Main   |
| Safety & Health Representatives | Hai Ngo   | 3598                         | <a href="mailto:Hai.ngo@uwa.edu.au">Hai.ngo@uwa.edu.au</a>   | Botany L2  |
| Senior Scientific Officer       | Greg Cawthray   | 1789                         | <a href="mailto:greg.cawthray@uwa.edu.au">greg.cawthray@uwa.edu.au</a>   | Agri. Cntr L2  |
| Technical Team                  | Rick Roberts<br>Husnan Ziadi<br>Hai Ngo<br>Stephen Robinson | 2225<br>2225<br>3598<br>2225 | <a href="mailto:rick.roberts@uwa.edu.au">rick.roberts@uwa.edu.au</a><br><a href="mailto:husnan.ziadi@uwa.edu.au">husnan.ziadi@uwa.edu.au</a><br><a href="mailto:hai.ngo@uwa.edu.au">hai.ngo@uwa.edu.au</a><br><a href="mailto:stephen.robinson@uwa.edu.au">stephen.robinson@uwa.edu.au</a> | Zoology L2<br>Zoology L2<br>Soil Science<br>Zoology L2 |

# WHO TO CONTACT

See below a list of who to contact in regards to any particular matter, within the School of Biological Sciences. If there is any confusion about who to contact; please contact Lindie Watkins at [admin-sbs@uwa.edu.au](mailto:admin-sbs@uwa.edu.au) for more information.

| FOR  | NAME                            | EXT          | EMAIL  |
|--|---------------------------------|--------------|--|
| <b>EMERGENCIES</b>   | <b>EMERGENCY</b>                | <b>2222</b>  | <b>(24 hrs) (6488 2222 from ext ph)</b>                              |
| Maintenance Requests   | Jax Ford                        | 2206         | admin-sbs@uwa.edu.au   |
| Safety & Health Representative / Hazard Reporting  | Hai Ngo                         | 2225         | hai.ngo@uwa.edu.au   |
| Safety Inductions  | Stephen Robinson                | 3233         | stephen.robinson@uwa.edu.au  |
| Biosafety & Radiation  | Husnan Ziadi                    | 2225         | husnan.ziadi@uwa.edu.au  |
| Plant Growth Facility  | Robert Creasy                   | 8549         | robert.creasy@uwa.edu.au   |
| Finance<br><i>Expense Claim Progress, Purchasing</i>   | Science-Finance                 | -            | purchasing-fsci@uwa.edu.au   |
| HR<br><i>Contracts, Timesheets, Leave, Payroll, Misconduct</i>   | SDC HR Science                  | 3569         | Hr-science@uwa.edu.au  |
| Travel Bookings  | Indiana Reid                    | 2062         | Admin-sbs@uwa.edu.au   |
| Honours & Masters support  | Christine Riordan               | 3532         | <a href="mailto:projects-sbs@uwa.edu.au">projects-sbs@uwa.edu.au</a> |
| Fieldwork Applications   | Supervisor / Tech Team          | -            | rick.roberts@uwa.edu.au  |
| Diving & Boating   | Warren Starr<br>Rick Roberts    | -<br>2225    | warren.starr@uwa.edu.au<br>rick.roberts@uwa.edu.au                   |
| Vehicles   | Pauline Yeung                   | 2545         | admin-sbs@uwa.edu.au   |
| Animal Yards   | Rick Roberts                    | 2225         | rick.roberts@uwa.edu.au  |
| IT Help  | IT Support                      | 2999         | ithelp-sci@uwa.edu.au  |
| General Administration Zoology, <i>Card Access, Expense Claims, General Enquiries.</i>                                     | Jax Ford<br>or<br>Pauline Yeung | 2206<br>2545 | admin-sbs@uwa.edu.au   |
| General Administration Botany<br><i>Master keys Botany &amp; Central, Card Access, Vehicle Bookings, General Enquiries</i> | Pauline Yeung                   | 2545         | admin-sbs@uwa.edu.au   |

## MAJORS COORDINATORS

| SPECIALISATION        | COORDINATORS:    | EMAIL:   | EXT: |
|-----------------------|------------------|--|------|
| Botany                | Pauline Grierson | <a href="mailto:Pauline.grierson@uwa.edu.au">Pauline.grierson@uwa.edu.au</a> | 7926 |
|                       | Pieter Poot      | <a href="mailto:Pieter.poot@uwa.edu.au">Pieter.poot@uwa.edu.au</a>           | 2491 |
| Conservation Biology  | Nicki Mitchell   | <a href="mailto:Nicola.mitchell@uwa.edu.au">Nicola.mitchell@uwa.edu.au</a>   | 4510 |
|                       | Pieter Poot      | <a href="mailto:Pieter.poot@uwa.edu.au">Pieter.poot@uwa.edu.au</a>           | 2491 |
| Science Communication | Heather Bray     | <a href="mailto:Heather.bray@uwa.edu.au">Heather.bray@uwa.edu.au</a>         | 2508 |
|                       | Sam Illingworth  | <a href="mailto:Sam.illingworth@uwa.edu.au">Sam.illingworth@uwa.edu.au</a>   | 3926 |
| Marine Science        | Renae Hovey      | <a href="mailto:Renae.hovey@uwa.edu.au">Renae.hovey@uwa.edu.au</a>           | 2214 |
|                       | Jane Prince      | <a href="mailto:Jane.prince@uwa.edu.au">Jane.prince@uwa.edu.au</a>           | 1469 |
| Zoology               | Jon Evans        | <a href="mailto:Jonathan.evans@uwa.edu.au">Jonathan.evans@uwa.edu.au</a>     | 2010 |
|                       | Jason Kennington | <a href="mailto:Jason.kennington@uwa.edu.au">Jason.kennington@uwa.edu.au</a> | 3233 |

## HONOURS COORDINATORS

| SPECIALISATION                | COORDINATORS:     | EMAIL:   | EXT: |
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| Botany                        | Jacqueline Batley | <a href="mailto:Jacqueline.batley@uwa.edu.au">Jacqueline.batley@uwa.edu.au</a> | 5929 |
|                               | Pauline Grierson  | <a href="mailto:Pauline.grierson@uwa.edu.au">Pauline.grierson@uwa.edu.au</a>   | 7926 |
| Conservation Biology          | Nicki Mitchell    | <a href="mailto:Nicola.mitchell@uwa.edu.au">Nicola.mitchell@uwa.edu.au</a>     | 4510 |
|                               | Pieter Poot       | <a href="mailto:Pieter.poot@uwa.edu.au">Pieter.poot@uwa.edu.au</a>             | 2491 |
| Science Communication         | Heather Bray      | <a href="mailto:Heather.bray@uwa.edu.au">Heather.bray@uwa.edu.au</a>           | 2508 |
|                               | Sam Illingworth   | <a href="mailto:Sam.illingworth@uwa.edu.au">Sam.illingworth@uwa.edu.au</a>     | 3926 |
| Marine Science                | Renae Hovey       | <a href="mailto:Renae.hovey@uwa.edu.au">Renae.hovey@uwa.edu.au</a>             | 2214 |
|                               | Jane Prince       | <a href="mailto:Jane.prince@uwa.edu.au">Jane.prince@uwa.edu.au</a>             | 1469 |
| Zoology                       | Jan Hemmi         | <a href="mailto:Jan.hemmi@uwa.edu.au">Jan.hemmi@uwa.edu.au</a>                 | 3117 |
|                               | Mandy Ridley      | <a href="mailto:Mandy.ridley@uwa.edu.au">Mandy.ridley@uwa.edu.au</a>           | 3740 |
| Research project coordinators | Jan Hemmi         | <a href="mailto:Jan.hemmi@uwa.edu.au">Jan.hemmi@uwa.edu.au</a>                 | 3117 |
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## MASTERS OF BIOLOGICAL SCIENCES

### (Coursework and Coursework & Dissertation) - Specialisation Coordinators

| SPECIALISATION                | COORDINATORS:    | EMAIL:   | EXT: |
|-------------------------------|------------------|--|------|
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|                               | Pieter Poot      | <a href="mailto:Pieter.poot@uwa.edu.au">Pieter.poot@uwa.edu.au</a>           | 2491 |
| Ecology                       | Pauline Grierson | <a href="mailto:Pauline.grierson@uwa.edu.au">Pauline.grierson@uwa.edu.au</a> | 7926 |
|                               | Greg Skrzypek    | <a href="mailto:Greg.skrzypek@uwa.edu.au">Greg.skrzypek@uwa.edu.au</a>       | 4584 |
| Marine Biology                | Renae Hovey      | <a href="mailto:Renae.hovey@uwa.edu.au">Renae.hovey@uwa.edu.au</a>           | 2214 |
|                               | Jane Prince      | <a href="mailto:Jane.prince@uwa.edu.au">Jane.prince@uwa.edu.au</a>           | 1469 |
| Zoology                       | Jon Evans        | <a href="mailto:Jonathan.evans@uwa.edu.au">Jonathan.evans@uwa.edu.au</a>     | 2010 |
|                               | Jason Kennington | <a href="mailto:Jason.kennington@uwa.edu.au">Jason.kennington@uwa.edu.au</a> | 3233 |
| Science Communication         | Heather Bray     | <a href="mailto:Heather.bray@uwa.edu.au">Heather.bray@uwa.edu.au</a>         | 2508 |
|                               | Sam Illingworth  | <a href="mailto:Sam.illingworth@uwa.edu.au">Sam.illingworth@uwa.edu.au</a>   | 3926 |
| Research project coordinators | Jan Hemmi        | <a href="mailto:Jan.hemmi@uwa.edu.au">Jan.hemmi@uwa.edu.au</a>               | 3117 |
|                               | Mandy Ridley     | <a href="mailto:Mandy.ridley@uwa.edu.au">Mandy.ridley@uwa.edu.au</a>         | 3740 |

| SUPERVISORS   | TOPIC  | LEVEL  |
|---|--|--|
| <b>Prof Jacqui Batley</b><br>jacqueline.batley@uwa.edu.au   | <b>Evolution of disease resistance genes</b><br>Plant disease resistance genes play a critical role in providing resistance against pathogens. The largest families of resistance genes are the nucleotide binding site and leucine rich repeat genes (NBS-LRRs) and receptor like proteins (RLPs). Hundreds of these genes are present within the genome, however the evolutionary history of these genes is not fully understood. Genome wide identification of these genes within and between species allows a study of which genes are core to a species or family and which have variable roles. This project aims to identify all these genes within <i>Brassica</i> species and wild relative species, perform comparative analysis within and between the species and provide an understanding of the evolution of these genes   | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Prof Jacqui Batley</b><br>jacqueline.batley@uwa.edu.au<br><br><b>Dr Jing Li</b><br>jing.li@uwa.edu.au  | <b>A novel biotechnological approach to protect crops from insect pests</b><br>New approaches are required to control insect pests which cause enormous global crop losses. Phytophagous insects are incapable of synthesizing cholesterol. Cholesterol is a precursor of the molting hormone. Insects rely on converting host phytosterols to cholesterol. There are stringent structural demands on phytosterols used as substrates, therefore some phytosterols cannot be utilized by insects. This important pest-host interaction provides a unique platform from which to explore the opportunity for a new insect pest control strategy. The project aims to develop a novel technology which is achieved by modifying plants to produce non-utilizable sterols. The plants with modified sterols will unable to support insect growth & reproduction but will nevertheless function normally in plants. The specific aims are to modify canola plant sterols by overexpression/knock-out (using Crispr technology) of novel sterol biosynthetic genes, or by exploiting natural variation in sterols already present in canola and introgressing non-utilizable sterols from other Brassicaceae species. | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Prof Jacqui Batley</b><br>jacqueline.batley@uwa.edu.au   | <b>Genomics of Plant pathogen interactions</b><br>Research on the interactions between plants and pathogens has become one of the most rapidly moving fields in the plant sciences, findings of which have contributed to the development of new strategies and technologies for crop protection. A good example of plant and pathogen evolution is the gene-for-gene interaction between the fungal pathogen <i>Leptosphaeria maculans</i> , causal agent of Blackleg disease, and <i>Brassica</i> crops (canola, mustard, cabbage, cauliflower, broccoli, Brussels sprouts). The newly available genome sequences for <i>Brassica</i> spp. and <i>L. maculans</i> provide the resources to study the co-evolution of this plant and pathogen. The aim of this project is to use next generation sequencing technologies to characterise the diversity and evolution of these genes in different wild and cultivated <i>Brassica</i> species. This will involve phenotypic analysis of the disease in a variety of cultivars and species and association genetics to link to the phenotype  | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Karen Bell</b><br>karen.bell@csiro.au<br>karen.bell@uwa.edu.au<br><br><b>Bruce Webber</b><br>bruce.webber@csiro.au,<br>bruce.webber@uwa.edu.au   | <b>Detecting the floral fingerprint of biocultural dispersal</b><br>Biocultural practices have been influencing the evolution, dispersal and distribution of desirable plant species since the earliest migrations of humans, many thousands of years ago. Ancient human-mediated change is often ignored in countries such as Australia that were considered to have a 'hunter-gatherer' culture prior to British colonisation. It is clear that this is an oversight, and ancient anthropogenic influences are often not well considered in studies on biogeography and community ecology, yet ancient dispersal events may well have left a significant and detectable influence on present day community assemblages. This project will examine potential ancient human-mediated species dispersal into and around northern Australia, through distribution mapping, evolutionary genetics and/or biogeographic analysis.  | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Karen Bell</b><br>karen.bell@csiro.au<br>karen.bell@uwa.edu.au<br><br><b>Raphael Didham</b><br>raphael.didham@uwa.edu.au<br>raphael.didham@csiro.au<br><br><b>Bruce Webber</b><br>bruce.webber@csiro.au<br>bruce.webber@uwa.edu.au | <b>Using DNA metabarcoding to detect plant-pollinator interactions.</b><br>Pollination is an essential ecosystem service but can be difficult to directly observe. New methods using DNA metabarcoding may help to determine which plants are being visited by which pollinator. This project will use a combination of traditional field observations, microscopic analysis of pollen, and DNA metabarcoding of pollen, to detect plant-pollinator interactions.  | <b>Masters</b><br><b>PhD</b>                   |

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|--|---|---|
| <p><b>Karen Bell</b><br/>karen.bell@csiro.au<br/>karen.bell@uwa.edu.au</p> <p><b>Bruce Webber</b><br/>bruce.webber@csiro.au,<br/>bruce.webber@uwa.edu.au</p> <p><b>Martin Nunez</b><br/>martin.nunez@csiro.au<br/>nunezm@gmail.com</p> | <p><b>Tracing the introduction history of invasive plants.</b><br/>The movement of plant species from one place to another is a significant anthropogenic impact. The introduction of plant species to new environments can have significant negative impacts. Following introduction to a new location, plant species can become invasive, threatening native species, the environment, agricultural productivity, and access to Indigenous cultural sites. Understanding the dispersal pathways that have led to the introduction of invasive species can allow for better management, as well as preventing future invasions. This project will use evolutionary genetics and phylogeography to determine geographic origin and introduction pathways for invasive plants in Australia.</p>  | <p><b>Honours</b><br/><b>Masters</b><br/><b>PhD</b></p> |
| <p><b>Dr Heather Bray</b><br/>heather.bray@uwa.edu.au</p>  | <p><b>Media framing of scientific issues</b><br/>The media has an important role in shaping people's understanding of scientific issues. Framing is when certain aspects of a story are made more or less prominent, or when particular types of metaphors are used to help audiences understand a story, but it can also influence <b>how</b> a story is understood. In this project, you are free to pursue an issue of your choice (eg coronavirus, the recent bushfires) and you will learn both qualitative and quantitative research techniques grounded in the social sciences to find out how the scientific issue is being 'made public' in Australia.</p>   | <p><b>Honours</b><br/><b>Masters</b><br/><b>PhD</b></p> |
| <p><b>Dr Heather Bray</b><br/>heather.bray@uwa.edu.au</p>  | <p><b>Employment outcomes for science communication students</b><br/>Employers specifically look for good communication skills when hiring science students. However, we don't know specifically which communication skills or theoretical knowledge is important for employers who are specifically looking to hire science communication specialists. In this project, you will explore what science communication employers (eg. museums, science centres, zoos, government, etc) view as desirable graduate outcomes for potential employees.</p>   | <p><b>Honours</b><br/><b>Masters</b><br/><b>PhD</b></p> |
| <p><b>Dr Bruno Buzatto,</b><br/>bruno.buzatto@uwa.edu.au</p> <p><b>A/Prof Joseph Tomkins</b><br/>joseph.tomkins@uwa.edu.au</p>   | <p><b>Male dimorphism and sexual conflict</b><br/>Male dimorphism usually reflects alternative reproductive tactics among males: the large male morphs typically guard females or reproductive territories and have more elaborate weaponry; the small male morphs sneak copulations and have reduced weaponry. In the bulb mite <i>Rhizoglyphus echinopus</i>, fighters have a thick and sharp pair of legs and kill rival males, whereas scramblers search for unguarded females. We have colonies of bulb mites in the lab that have been under artificial selection on the thickness of fighter legs for several generations. The aim of this honours project will be to assess whether selection for thicker legs in fighters generated any response in females. If so, then a sexual conflict should arise and constrain the evolution of sexual dimorphism and male dimorphism, which would be a very significant finding in evolutionary biology. The work will involve manipulating mites under the microscope and measuring their legs with image software.</p>           | <p><b>Honours</b></p>                                   |
| <p><b>Dr Bruno Buzatto,</b><br/>bruno.buzatto@uwa.edu.au</p> <p><b>A/Prof Joseph Tomkins</b><br/>joseph.tomkins@uwa.edu.au</p>   | <p><b>Selection for larger weapons and fight performance</b><br/>Male dimorphism usually reflects alternative reproductive tactics among males: the large male morphs typically guard females or reproductive territories and have more elaborate weaponry; the small male morphs sneak copulations and have reduced weaponry. In the bulb mite <i>Rhizoglyphus echinopus</i>, fighters have a thick and sharp pair of legs and kill rival males, whereas scramblers search for unguarded females. We have colonies of bulb mites in the lab that have been under artificial selection on the thickness of fighter legs for several generations. The aim of this project will be to assess whether selection for thicker legs in fighters generated coevolutionary responses in fighting performance. If so, we will have gathered the first direct evidence for the positive effect of thick legs in winning fights in mites! The work will involve setting up and observing male-male fights between mites under the microscope and measuring their legs with image software.</p> | <p><b>Honours</b><br/><b>Masters</b></p>                |
| <p><b>Dr Belinda Cannell</b><br/>belinda.cannell@uwa.edu.au</p> <p><b>Dr Renae Hovey</b><br/>renae.hovey@uwa.edu.au</p>  | <p><b>Population characteristics of Little Penguins in King George Sound, Albany</b><br/>The largest colony of Little Penguins in Western Australia was located, until recently, on Penguin Island. However, this colony has reduced by more than 50% in the last decade, largely attributed to a reduction in local fish abundance due to a warming trend in water temperature as well as increasing interactions with watercraft. Sadly, a population viability analysis based on current survival and breeding success has identified that the colony will be extinct within 40 years. The largest colony in WA is now likely to be located &gt; 500 km south, on Breaksea Island, &lt;15 km from a major shipping port in King George Sound. However, no information is available on the population ecology of the penguins in this region. This project will investigate some key population characteristics of the Little Penguins with the aid of artificial nestboxes that will be monitored regularly throughout the breeding season.</p>                                  | <p><b>Honours</b><br/><b>Masters</b></p>                |

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|---|--|---|
| <p><b>Dr Belinda Cannell</b><br/>belinda.cannell@uwa.edu.au</p> <p><b>Dr Harriet Paterson</b><br/>harriet.paterson@uwa.edu.au</p> | <p><b>Eavesdropping on the lives of shearwaters</b><br/>The objective of this study is to investigate the vocalizations of Flesh-footed Shearwaters on Muttonbird Island (Albany) while they occupy their burrows during their breeding season. This will increase our understanding of their behaviour during breeding. This project uses a novel sound recording device operated by a Raspberry Pi Computer, a credit-card-sized computer that can be used, amongst other things, for electronic projects. It is equipped with microphones and an infrared camera to observe birds arriving and leaving the burrow. Data have already been collected from the 2017/18 and 2018/19 seasons and we expect to collect more in 2019/20. The data will be interrogated as a desk top study, but the student will be expected to visit the site when the equipment is deployed or retrieved. The candidate will identify and describe vocalisations encountered and assign likely functions to them. The range of vocalisations encountered are likely to include those related to reforming pair bonds, mating, contact calls and sounds related to hatching of chicks, chicks begging and being fed. The candidate may be based at either the Crawley or Albany campus, but must be enrolled through CENRM at the Albany campus. The preferred start date is Semester 2 2019. A top up of \$500 will be offered to cover costs of the project.</p> | <p><b>Honours</b><br/>(must be enrolled through CENRM at Albany campus)</p> |
| <p><b>Dr Cecile Dang</b><br/>cecile.dang@dpird.wa.gov.au</p> <p><b>Prof Jacqui Batley</b><br/>Jacqueline.batley@uwa.edu.au</p>    | <p><b>Investigation of microorganisms associated with health issues in pearl oysters <i>Pinctada maxima</i> from northern Australia</b><br/>The pearl oyster industry is one of Australia's most valuable and iconic fisheries, creating significant economic and employment opportunities across Northern Australia. However, as with any major animal production industry, health issues are persistent obstacles inhibiting productivity. Since 2006, the pearl oyster (<i>Pinctada maxima</i>) farming industry in Western Australian has been hampered by health and productivity issues with no identified cause(s).<br/>This project aims to characterise active microorganisms (fungus, bacteria, virus) in moribund oysters in order to understand which ones are associated with health issues. Our laboratory has collected unique samples since June 2017 from moribund and healthy adult and spat pearl oysters, which will be used in this study. This molecular work will involve next-generation sequencing (extraction of nucleic acid, library preparation, etc. ) and bioinformatics analysis.</p>  | <p><b>Honours</b><br/><b>Masters</b></p>                                    |
| <p><b>Dr Cecile Dang</b><br/>cecile.dang@dpird.wa.gov.au</p> <p><b>Prof Jacqui Batley</b><br/>Jacqueline.batley@uwa.edu.au</p>    | <p><b>Pathogenicity of <i>Vibrio</i> spp. in pearl oysters <i>Pinctada maxima</i> from northern Australia</b><br/>The pearl oyster industry is one of Australia's most valuable and iconic fisheries, creating significant economic and employment opportunities across Northern Australia. However, as with any major animal production industry, health issues are persistent obstacles inhibiting productivity. Since 2006, the pearl oyster (<i>Pinctada maxima</i>) farming industry in Western Australian has been hampered by health and productivity issues with no identified cause(s).<br/>Bacteria belonging to <i>Vibrio alginolyticus</i> clade have been associated with moribund oysters and can harbour plasmids, which contain virulence genes and may be responsible for the pathogenicity of the bacteria. This project proposes to characterise the virulence factors of <i>Vibrio alginolyticus</i> and assess which environmental factors enhance the pathogenicity. This work will involve bacteriology (culture techniques), molecular biology (qPCR and next-generation sequencing), and microscopy techniques.</p>   | <p><b>Honours</b><br/><b>Masters</b></p>                                    |
| <p><b>Harriet Davies</b><br/>harriet.davies@uwa.edu.au</p> <p><b>Dr Tim Langlois</b><br/>tim.langlois@uwa.edu.au</p>              | <p><b>Developing Sea Country management protocols through combining traditional ecological knowledge of Indigenous Australians and Western Science.</b><br/>Indigenous Australians have a profound connection to nature and a cultural obligation to take care of Country. As a result, Indigenous people have been sustainably managing their marine estates for millennia. There is an increasing interest in documenting and embedding traditional knowledge into marine management and monitoring yet little work has been done in developing methods and protocols to achieve these goals. This project will build upon participatory mapping methods to document knowledge of senior knowledge holders to help inform marine park and fisheries management in Western Australia.</p>   | <p><b>Honours</b><br/><b>Masters</b><br/><b>PhD</b></p>                     |

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| <b>Raphael Didham</b><br>raphael.didham@csiro.au,<br>raphael.didham@uwa.edu.au<br><b>Martin Nunez</b><br>martin.nunez@csiro.au<br>nunezm@gmail.com<br><b>Bruce Webber</b><br>bruce.webber@csiro.au<br>bruce.webber@uwa.edu.au | <p><b>How do plant-insect interactions differ between native and introduced ranges?</b></p> <p>When plant species are introduced to new environments, this disrupts its ecological interactions. Ecological interactions between species are the glue that holds ecosystems together, but equally, novel interactions can threaten ecosystem resilience. Projects are available examining the insect communities associated with threatening weeds in Australia, both in their native and introduced range, including fieldwork across WA.</p>   | <b>Masters</b><br><b>PhD</b>                   |
| <b>Prof Michael Douglas</b><br>michael.douglas@uwa.edu.au<br><br><b>Dr Leah Beesley</b><br>leah.beesley@uwa.edu.au<br><br><b>Prof Matt Hipsey</b><br>matt.hipsey@uwa.edu.au   | <p><b>Do thermal associations drive the spatial aggregation of fish in dry season pools of the Fitzroy River?</b></p> <p>Dry season waterholes in intermittent rivers are important refuges for biota, including fish. These waterholes are typically supported through the dry season by the influx of cool groundwater. Water resource development that lowers the water table and reduces the depth of refuge pools may impact the suitability of these habitats for fish. This study will map the depth and temperature of a number of pools using GPS data-logger technology. Sonar will also be used to map the location of fish during different times of the day (dawn, midday, dusk, night). Temperature-related changes in fish habitat use will be assessed by examining the extent to which fish spatial positioning is linked with temperature. This project will contribute to determining the environmental flow requirements of the Fitzroy River, and is part of National Environmental Sciences Program.</p> | <b>Honours</b><br><b>Masters</b>               |
| <b>Prof Dave Edwards</b><br>dave.edwards@uwa.edu.au<br><b>Dr Elizabeth Sinclair</b><br>elizabeth.sinclair@uwa.edu.au<br><b>Dr Philipp Bayer</b><br>philipp.bayer@uwa.edu.au   | <p><b>Comparative Genomics of Seagrass</b></p> <p>Comparative genomics provide a powerful tool to study evolution. Marine plants, the seagrasses, are an extremely old polyphyletic group representing multiple 'return to sea' events. These independent events resulted in habitat-driven solutions to adaptation to a marine environment. A recent genome comparison among two seagrass species provided strong evidence for convergent evolution. This project will compare multiple seagrass genomes to further explore their evolution and to identify genes associated with stress responses and extreme climate events. Candidates are expected to have an understanding of Linux.</p>   | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Prof Dave Edwards</b><br>Dave.Edwards@uwa.edu.au   | <p><b>Applied bioinformatics</b></p> <p>Data is increasingly abundant in biology, and being able to analyse data is fundamental to asking biological questions. The applied bioinformatics group at UWA is a dedicated computational group asking biological questions using big data and high performance computing. Projects range from genome and pangenome assembly and annotation, population analysis, trait association, evolutionary studies and crop improvement, predominantly using wild plant and crop species, though also venturing into animal and even human genomics. Candidates are expected to have a good understanding of biology and use of Linux and will receive training in the use of high performance computing in biology. Please contact Dave Edwards to discuss specific opportunities.</p>  | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Prof Jon Evans,</b><br>jonathan.evans@uwa.edu.au   | <p><b>How is a paternal effect transmitted to offspring? A case study on guppies</b></p> <p>Recent research has shown that an individual's experiences can be transmitted to offspring independently of genes - so called parental effects. In the case of males, such information is known to be transmitted to offspring via ejaculates, a phenomenon we have termed 'ejaculate-mediated paternal effects' because in many cases males provide nothing more than the ejaculate during mating. This project will involve collaboration with molecular biologists to understand the proximate (causal) basis for EMPEs, which may involve numerous epigenetic/genetic regulatory systems. Research opportunities at either PhD or Honours level are available to address this question, using experimental and quantitative genetic approaches in the guppy <i>Poecilia reticulata</i>. This project is subject to a pending funding application with the ARC and if funded will be available in early 2021</p>                | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Prof Jon Evans,</b><br>jonathan.evans@uwa.edu.au   | <p><b>Ejaculate-mediated paternal effects as sources of non-genetic inheritance in guppies</b></p> <p>This project aims to unravel the evolutionary importance of ejaculate-mediated paternal effects, through which paternal lifestyle factors and experiences influence offspring growth and health independently of genes. This project will focus on a number of environmental factors (e.g. pollution, predation etc.) experienced by adult males, as simulated during experimental laboratory procedures. By identifying non-genetic sources of inheritance the project expects to generate new knowledge that will be relevant across the biological, medical and agricultural sectors.</p>   | <b>Honours</b><br><b>Masters</b>               |

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| <b>Prof Jon Evans,</b><br>jonathan.evans@uwa.edu.au   | <p><b>Sex in the dynamic ocean: the consequences of environmental-mediated changes to sperm for offspring phenotypes in marine broadcast spawning invertebrates</b></p> <p>Over the last decade or so we have come to realise that sperm can be highly sensitive to environmental variables, and that these effects can have profound influences on offspring fitness. In this project, you will have the opportunity of designing an experiment that explores these effects in the mussel <i>Mytilus galloprovincialis</i>. By incorporating an experimental approach (where sperm are exposed to different environmental treatments) within a quantitative genetic breeding design, you will determine how much variance in offspring fitness can be attributable to environmental effects (i.e. due to changes in the sperm environment prior to fertilization) and genetic effects (i.e. due to the sire's intrinsic genetic 'quality'). The results from this project could have profound implications for studies that use quantitative genetic approaches to estimate genetic variation in offspring traits without considering the possible role of sperm-moderated paternal effects.</p>  | <b>Honours<br/>Masters</b> |
| <b>Prof Jon Evans,</b><br>jonathan.evans@uwa.edu.au   | <p><b>Can ocean pH influence gamete signalling mechanism in broadcast spawning marine invertebrates?</b></p> <p>Mussels have proved to be superb models for understanding the role that egg chemoattractants (chemical cues realised by eggs to attract sperm) play in moderating gamete interactions. Evidence from our lab has shown that in the blue mussel, <i>Mytilus galloprovincialis</i> egg chemoattractants selectively attract sperm from genetically compatible males, a process we term 'differential sperm chemotaxis'. However, the efficacy of egg chemoattractants to effectively exert this form of 'gamete choice' may depend on the chemical environment in which sperm chemotaxis occurs. In this project, you will determine whether seawater pH (acidity) influences gamete signalling processes in mussels, and thus evaluate the extent to which predicted changes in ocean chemistry may disrupt critical processes that moderate reproduction in marine invertebrates.</p>  | <b>Honours<br/>Masters</b> |
| <b>Assoc/Prof Patrick Finnegan</b><br>patrick.finnegan@uwa.edu.au<br><br><b>E/Prof Hans Lambers</b><br>hans.lambers@uwa.edu.au  | <p><b>Nutrient acquisition in <i>Hakea prostrata</i> (Proteaceae)</b></p> <p>The Proteaceae (banksia, grevillea, etc.) are incredibly well adapted to the nutrient poor soils of Western Australia. Our model plant is <i>Hakea prostrata</i> (Proteaceae), a plant that grows on some of the poorest soils in the world. We are identifying the genes that control the up-take and transport of the essential nutrients phosphorus and nitrogen around <i>Hakea prostrata</i> and are involved in its profound nutrient use efficiency. We are particularly interested in exploring the trait of nitrate restraint, which we recently discovered in <i>H. prostrata</i>. Unlike other plants, <i>H. prostrata</i> only imports the amount of nitrate it needs to support growth. Other plants store excess nitrate in the vacuole. We are interested to learn whether convergent evolution has provided other species with nitrate restraint in our nutrient impoverished environment. Depending on the direction you decide to take, you will conduct plant ecophysiological and physiological experiments and perhaps make use of our in-house <i>Hakea prostrata</i> genome sequence and RNAseq data, supplemented with your own quantitative PCR results.</p> | <b>Honours<br/>Masters</b> |
| <b>Assoc/Prof Patrick Finnegan</b><br>patrick.finnegan@uwa.edu.au   | <p><b>Leaf functional traits in Proteaceae from southern China</b></p> <p>The Proteaceae (banksia, grevillea, etc.) are considered to be a southern hemisphere plant family. Yet, two genera, <i>Helicia</i> and <i>Helicopisis</i>, are found in Asia. In fact, <i>Helicia</i> are found as far north as southern Japan. How did they get there? What traits allowed these plants to prosper progressively through the tropics, sub-tropics and into the temperate regions of Asia? Perhaps leaf functional traits which can give insights into traits such as plant water relations and photosynthetic capacity can give us some clues. You will work with micrographs of leaves from five species of Proteaceae from southern China to compare leaf functional traits from these species with those of other species of Proteaceae and other species from southern China.</p>   | <b>Honours<br/>Masters</b> |
| <b>E/Prof Hans Lambers</b><br>hans.lambers@uwa.edu.au<br><br><b>Assoc/Prof Patrick Finnegan</b><br>patrick.finnegan@uwa.edu.au<br><br><b>Dr Kosala Ranathunge</b><br>kosala.ranathunge@uwa.edu.au | <p><b>Why do Fabaceae, Myrtaceae and Proteaceae co-dominate on the most nutrient impoverished soils on earth?</b></p> <p>The soils of southwestern Australia are among some of the oldest and most nutrient impoverished soils on earth. They support a hyper-diverse flora that is dominated by species from three families - Fabaceae, Myrtaceae and Proteaceae. We know much about the specific adaptations that allow the Proteaceae to live on these soils, such as cluster roots that mobilise phosphate, highly proficient phosphorus remobilisation from leaves and roots, low levels of ribosomal RNA and phospholipids in leaves, delayed greening in young leaves, preferential allocation of phosphorus to photosynthetic cells, among others. By comparison, we know very little about the adaptations that allow Fabaceae and Myrtaceae to co-dominate. This project will focus on plants in Alison Baird Reserve in Perth to investigate the ecophysiological and physiological adaptations in leaves and roots that allow members of these families to live in nutrient poor environments.</p>   | <b>Honours<br/>Masters</b> |

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| <b>A/Professor Lindy Fitzgerald</b><br>lindy.fitzgerald@curtin.edu.au  | <p><b>Limiting damage following neurotrauma</b></p> <p>Traumatic injury to the central nervous system has serious and long-term functional consequences. We have demonstrated that oxidative stress in the cells that make the myelin required for efficient functioning of the nervous system is associated with disruptions to myelin structure and chronic functional loss. Here we will use <i>in vivo</i> models of neurotrauma and assess the mechanisms of damage to myelin and the contribution of inflammatory cells both at the site of injury and remotely. We will use inhibitors that will help us determine which of the changes lead to loss of function, and these may serve as therapeutic strategies.</p>   | <b>Honours</b><br><b>PhD</b>                   |
| <b>Pauline Grierson</b><br>Pauline.Grierson@uwa.edu.au,<br><b>Svenja Tulipani ( DWER)</b><br><b>Greg Skrzypek</b><br>Grzegorz.Skrzypek@uwa.edu.au<br><b>Brad Degens (DWER)</b>       | <p><b>Managing excess nutrients in aquatic ecosystems - understanding interactions between dissolved organic matter and phosphorus-binding clays.</b> This research project will compare DOM adsorption by Phoslock® and HT-clay and investigate how this varies across a range of environmental conditions (e.g. salinity and P concentrations). The project will include a range of lab experiments to elucidate if particular types of DOM are preferentially retained by the clays. Outcomes from the project will help optimise both the efficacy of clay applications and also inform understanding of any potential environmental impacts of clay treatment on waterways. The project is supported by DWER will also offer the opportunity to experience fieldwork for the collection of water samples in the Mandurah region.</p>   | <b>Honours</b><br><b>Masters</b>               |
| <b>Dr Cyril C. Grueter</b><br>cyril.grueter@uwa.edu.au<br><b>Prof Leigh Simmons</b><br>leigh.simmons@uwa.edu.au  | <p><b>Sexual selection in action: risk taking in humans</b></p> <p>Sexual selection theory predicts that males will be more prone to taking risks than females and that males use risk taking as a mate advertisement strategy. These predictions can be tested by using everyday situations such as crossing a busy road. The attractiveness of physical risk taking in potential mates has received relatively little empirical attention, but can be assessed using questionnaire data.</p>  | <b>Honours</b>                                 |
| <b>Assoc. Prof. Jan Hemmi</b><br>jan.hemmi@uwa.edu.au  | <p><b>Heart rate monitoring of aquatic invertebrates</b></p> <p>Heart rate is well known as an indicator of physiological 'state', activity and stress in animals such as mammals, including humans. Heart rate varies similarly in invertebrates such as crabs and molluscs, providing a method to monitor the animals to determine their state of physiological stress (e.g. in response to pollutants), to optimise husbandry for welfare reasons, or to maximise growth rates in aquaculture. We have constructed a small electronic package comprising an infrared (IR) light emitting diode (LED) and IR detector that can be mounted on the shell of a mollusc or carapace of a crab and used to monitor heart rate with minimal impact on the animal. We will use this to measure the affect of physico-chemical environmental conditions such as dissolved oxygen tension, temperature, and pH on aquatic invertebrates including farmed animals such as abalone and marron. We will also investigate heart rate in the context of marine invertebrates with complex behavioural repertoires and/or that live in environmentally highly varying conditions (e.g. fiddler crabs).</p> | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Assoc. Prof Jan Hemmi</b><br>jan.hemmi@uwa.edu.au<br><b>Katarina Doughty</b><br>katarina.doughty@research.uwa.edu.au<br><b>Isobel Sewell</b><br>isobel.sewell@research.uwa.edu.au | <p><b>Finding alternative food sources for aquaculture</b></p> <p>Aquaculture is the fastest growing human food production sector, tied closely with the continued increase in human population. With more food and more people, comes an increase in waste production. The use of the Black Soldier Fly (<i>Hermetia illucens</i>; BSF) has the potential to address waste issues, as it converts organic waste products into valuable nutrients, and food production concerns, as it can be incorporated into fish feeds. This project will assess the quality of fish fed an insect based diet and environmental parameters that influence fish growth and health. Fish growth, survival, condition factor, food conversion ratios, and other chemical properties will be analysed.</p>  | <b>Honours</b><br><b>Masters</b>               |
| <b>Assoc. Prof. Jan Hemmi</b><br>jan.hemmi@uwa.edu.au  | <p><b>Comparative colour vision and spatial vision in ants</b></p> <p>Ants have some of the smallest brains in the animal kingdom, yet they show a wide range of interesting behaviours, many of them visually driven. Their small size and limited head and eye space has forced them to optimise their visual system in very distinct ways. We have recently shown that one of the Australian bull ants, a species exclusively active in the dark of the night, has trichromatic colour vision like humans. As this is the first ant that has been shown to have more than two spectral photoreceptor types, this project will compare ants from different phylogenetic branches in order to understand the evolution of colour vision and spatial vision in ants in general. This project runs in collaboration with researchers from Macquarie University and will use a range of complementary techniques (physiology, behaviour and possibly molecular biology).</p>  | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |

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| <b>Assoc. Prof. Jan Hemmi</b><br>jan.hemmi@uwa.edu.au  | <p><b>How fiddler crabs see the world</b></p> <p>This project aims to understand how animals, in particular fiddler crabs, see their world. Using a mix of behavioural, physiological and anatomical experiments, we seek to understand how these animals see colours, patterns and polarisation, and how these visual capabilities influence how these crabs interact with their environment, their predators and conspecifics. Experiments will be conducted using our resident UWA fiddler crab colony, housed in a 4 m<sup>2</sup> fully-functional artificial mudflat. You will discover how sensory information underpins animal behaviour, learn how to probe the visual capabilities of animals and, depending on your interests and abilities, learn different combinations of behavioural and physiological and possibly genetic techniques.</p>   | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Assoc. Prof. Jan Hemmi</b><br>jan.hemmi@uwa.edu.au<br><br><b>Dr Zahra Bagheri</b><br>zahra.bagheri@uwa.edu.au   | <p><b>The role of polarisation in navigation</b></p> <p>Polarisation vision is used by a variety of species in many important tasks, including navigation and orientation, communication and signalling, and as a possible substitute for colour vision. Fiddler crabs possess the anatomical structures necessary to detect polarised light, and occupy environments rich in polarisation cues. Unlike many insects, however, polarisation vision is not confined to the dorsal part of the eye, but crabs have full field polarisation vision. However, it is unknown whether they can use polarisation to find their direction back home.</p> <p>The aim of this project is to investigate the role of polarisation vision in path integration and homing in fiddler crabs using a modified polarisation monitor in an artificial mudflat. You will learn how animals use vision to navigate and how to "ask" animals what information they use to make important decision by performing well balanced experiments in a realistic environment.</p>  | <b>Honours</b><br><b>Masters</b>               |
| <b>Assoc. Prof. Jan Hemmi</b><br>jan.hemmi@uwa.edu.au  | <p><b>Escape responses in fiddler crabs</b></p> <p>How do animals decide when to escape from an approaching predator? We are trying to understand the sensory information animals underlying this decision. The results will tell us how animals measure risk and how they manage to avoid being eaten while still being able to feed and find mates. Fiddler crabs are highly visual animals that live under constant threat of predation from birds. Field experiments have shown that the crabs are not able to measure a predator's distance or their direction of movement – a problem they share with many other small animals. You will bring fiddler crabs into the laboratory and their escape decisions will be tested in our artificial mudflat (at UWA) and/or on a custom made treadmill controlled conditions. Depending on your interests, you can use a combination of behavioural and physiological measurements to understand the mechanisms underlying the crab's escape behaviour.</p>   | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Assoc. Prof. Jan Hemmi</b><br>jan.hemmi@uwa.edu.au  | <p><b>Eye movements for high resolution in fiddler crabs</b></p> <p>The compound eyes of arthropods such insects and crustaceans are well known for their low spatial resolution. By our visual standards, almost all these animals seem to have a hopelessly blurry view of the world. This low spatial resolution is due to the optical design of their eyes: in particular the relatively broad angular sensitivity of the ommatidia – the individual photoreceptor elements of the eye – and the interommatidial angle – the way in which each ommatidium's line of sight differs from that of its neighbour. If each ommatidium looks in a very different direction, it is inevitable that the whole eye's view will lack spatial detail. Unless, that is, arthropods have evolved a way to overcome this problem.</p> <p>In machine vision, a technique of subpixel interpolation is used to increase the resolution of an imaging system or camera. This is done by taking several images of a scene but shifting the image sensor slightly for each image. You will use macro high speed video to investigate whether fiddler crabs move their eyes in a way that would enable them to employ such sub-ommatidial interpolation.</p> | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Assoc. Prof. Jan Hemmi</b><br>jan.hemmi@uwa.edu.au<br><b>Dr Zahra Bagheri</b><br>zahra.bagheri@uwa.edu.au<br><b>Anna-Lee Jessop</b><br>anna-lee.jessop@uwa.edu.au | <p><b>Comparative eye anatomy</b></p> <p>We have recently developed an exciting new tool to measure the visual field of animals with compound eyes, such as ants and bees. MicroCT is a technique that uses x-rays to image eyes on a very fine spatial scale. We have now developed unique new software to analyse these 3D images and reconstruct how the eyes sample the world. This has never been done before. The output will be a much improved understanding of how animals see their world and much detail they can see. The speed and accuracy of this technique will allow you to compare numerous eyes and can form the bases used for a comparative study of fiddler crab eyes, or to compare the eyes of a range of other animals groups such as ants. For a PhD project, this could involve developing a new staining technique to investigate neural connections in the intact eye.</p>  | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |

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| <b>Assoc. Prof. Jan Hemmi</b><br>jan.hemmi@uwa.edu.au<br><br><b>Dr Zahra Bagheri</b><br>zahra.bagheri@uwa.edu.au   | <b>Sampling visual world</b><br>Visual systems are under strong selection pressure because they are often crucial in guiding the behaviour of animals. Physical constraints mean that an eye of a given size cannot simultaneously maximise both its resolution and sensitivity while maintaining the extent of its visual field. As a consequence, most eyes show distinct regional differences in how they allocate resolution and sensitivity. A new method, based on micro-CT, we have developed, predicts that fiddler crabs, have two parallel streaks of high resolution located just above and below the visual horizon. This is in stark contrast to previous results that such streaks of high resolution, which are very common in flat-world inhabitants, are centred on the horizon. We would like to confirm this exciting result with physiological recordings. You will learn how to measure the visual resolution of fiddler crab in different parts of the eye, using electrical recordings from the surface of the eye. | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Dr Zahra Bagheri</b><br>zahra.bagheri@uwa.edu.au<br><br><b>Assoc. Prof. Jan Hemmi</b><br>jan.hemmi@uwa.edu.au<br><br><b>Callum Donohue</b><br>callum.donohue@uwa.edu.au | <b>Selective attention in the context of escape</b><br>Risk assessment and decision-making is an essential process for animal survival. In natural environments, animals are constantly exposed to several threatening stimuli at any one time. It is not clear how animals make escape decisions in these situations. Do animals identify the most dangerous threat and organize their escape accordingly? Or do they try to escape from all threatening stimuli at the same time? To answer these questions, this project aims to study fiddler crabs escape response to multiple simultaneous threats. The study will test the effect of different stimulus characteristics such as visibility and speed on the crabs' risk assessment and decision-making process. The results will not only improve our understanding of how animals escape predators, but may also contribute to technologies such as robotic rescue.  | <b>Honours</b><br><b>Masters</b>               |
| <b>Assoc. Prof. Jan Hemmi</b><br>jan.hemmi@uwa.edu.au<br><br><b>Dr Tim Langlois</b><br>tim.langlois@uwa.edu.au<br><br><b>Callum Donohue</b><br>callum.donohue@uwa.edu.au   | <b>Taking the pulse of crustaceans – monitoring heart rate in response to environmental changes</b><br>Non-invasive measurements of physiological parameters can provide important insights into how short or long-term environmental changes impact on the health of species, populations, or individuals. The focus of this project is to test whether it is possible to use a small-scale optical heart rate monitor to understand (1) the impact of changes in environmental conditions such as temperature, water salinity and PH, or (2) stress - brought about by handling, transportation or exposure to dummy predators on the heart rate of either fiddler crabs or western rock lobsters. The outcomes of the study will help improve animal husbandry and transportation (rock lobster) or aid our understanding of how species respond behaviourally and physiologically to environmental stressors (fiddler crabs).  | <b>Honours</b><br><b>Masters</b>               |
| <b>Assoc. Prof. Jan Hemmi</b><br>jan.hemmi@uwa.edu.au<br><br><b>Anna-Lee Jessop</b><br>anna-lee.jessop@uwa.edu.au  | <b>The function of the lobula plate in crustaceans</b><br>The lobula plate is an optic neuropil (part of the brain) found in many species of arthropods. It has been extensively studied in dipterous insects such as blowflies, where its role is to process large-field motion information used for controlling gaze (optomotor responses). Blowflies use this information to stabilize themselves when moving, especially in flight. However, the functional significance of the lobula plate in crustaceans remains unknown. This study will aim to further understand the relationship between the lobula plate and the optomotor behaviour in crustaceans, by comparing behavioural measurements of eye stabilisation and Micro-CT (x-ray) measurements of the lobula plate structure in a range of crustacean species.  | <b>Honours</b><br><b>Masters</b>               |
| <b>Dr Renae Hovey</b><br>renae.hovey@uwa.edu.au<br><b>Dr Harriet Paterson</b><br>harriet.paterson@uwa.edu.au   | <b>Distribution of plastics in southern estuarine ecosystems, Western Australia</b><br>The impact plastic is having on the marine environment is rapidly becoming the issue of the millennium. It has negative impacts on biology and degrades the visible qualities of the ocean and the coast line. The south coast of Western Australia can be considered relatively pristine yet plastic has been found in unpopulated areas. We are offering 4 projects that investigate plastic distribution and ecological impacts in estuarine ecosystems which sit at the interface between land and sea.   | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Dr Sam Illingworth</b><br>sam.illingworth@uwa.edu.au  | <b>The Communication of Australian Bush Fires</b><br>The Australian Bush Fires of 2019/2020 took a tremendous toll on the environment, society, and economy. However, how were different publics aware of the extent of these bush fires, and how were they engaged in developing effective strategies to mitigate against their effects. In this project you will investigate the ways in which different publics (policymakers, journalists, community groups, etc.) were involved in dealing with the Australian Bush Fires, and the effect that this had in combatting them.   | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |

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| <b>Dr Sam Illingworth</b><br>sam.illingworth@uwa.edu.au  | <p><b>Climate Change and Games</b></p> <p>Analogue games (board games, card games, etc.) are a powerful way of communicating complex topics with a variety of different audiences, helping to localise and personalise issues that might otherwise be esoteric and of little immediate concern. In this project you will work with games design experts to create your own game that aims to develop dialogue around a certain aspect of climate change (e.g. ocean acidification, coral reef destruction, extreme weather events). Following the design and creation of the game you will measure its effectiveness as an intervention.</p>  | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Prof Simon Jarman</b><br>simon.jarman@uwa.edu.au  | <p><b>Comparing and modeling patterns of biodiversity</b></p> <p>Distributions of species composition and abundance can be modeled by a range of mathematical distributions. Different types of community are better described by some models than others. The aim of this project is to identify differences in the ability of mathematical predictions of species distribution to model observed biodiversity. The student will gather existing community biodiversity data from existing papers with a special focus on those that use DNA metabarcoding methods to describe biodiversity. They will then fit different models to the data under a range of parameters to determine the appropriate use of biodiversity models for environmental DNA metabarcoding analysis in particular and community types in general. The candidate should have good data analysis and scripting skills.</p>                           | <b>Honours</b><br><b>Masters</b>               |
| <b>Prof Simon Jarman</b><br>simon.jarman@uwa.edu.au<br><b>Dr Andrew Bissett</b><br>andrew.bissett@csiro.au | <p><b>How many species of Fungi are there in australian soils?</b></p> <p>Soil fungi are critical for crop production and maintaining the diversity of native species. Australia has a great range of soil types and vegetation types that make it one of the most biodiverse continents for most groups surveyed so far, such as plants and animals. Fungi are more difficult to study because there are fewer taxonomic experts trained in researching them and there are many cryptic species. In this project, DNA sequence data from the CSIRO's national fungal collection survey will be used to estimate species diversity in samples from across the country. Analysis of species accumulation and cross-site occurrence will be used to estimate the number of species of Fungi in Australia. The candidate should have good data analysis and programming/scripting skills in R, Python or a similar language.</p> | <b>Honours</b><br><b>Masters</b>               |
| <b>Dr Jennifer Kelley</b><br>jennifer.kelley@uwa.edu.au<br><b>Prof Jan Hemmi</b><br>jan.hemmi@uwa.edu.au   | <p><b>Assoc.</b></p> <p><b>Social behaviour and predation risk in freshwater fishes</b></p> <p>Detecting and avoiding predators is an essential part of life for almost all animals. Animals make the decision of when to respond to an approaching predator based on the perceived level of risk and factors such as the presence of other group members. This project uses a native freshwater fish, the western rainbowfish (<i>Melanotaenia australis</i>), to determine whether an individual's response to a simulated threat depends on the reactions of other members of the shoal. The work will contribute towards our understanding of how information about predation risk is transmitted among members of a social group. This project will be most suited to students interested in predator-prey interactions and grouping dynamics in animals.</p>  | <b>Honours</b><br><b>Masters</b>               |
| <b>Dr Jennifer Kelley</b><br>jennifer.kelley@uwa.edu.au<br><b>Prof Jan Hemmi</b><br>jan.hemmi@uwa.edu.au   | <p><b>Assoc.</b></p> <p><b>Perception of colour patterns in freshwater fishes</b></p> <p>Animal colour patterns (e.g. spots, stripes) are often used to thwart predators, by providing misleading information about a prey's size, shape and body movements. Although these patterns increase a prey's chance of survival, it is not clear how the colouration interferes with the predator's perceptual mechanisms to prevent attack. This project will use western rainbowfish (<i>Melanotaenia australis</i>) as predators to understand whether patterning can interfere with perception of prey shape, depth and distance from the viewer. The work will contribute towards our understanding of the function of colouration in animals and will be of particular interest to students interested in animal vision and visual perception.</p>  | <b>Masters</b><br><b>PhD</b>                   |
| <b>Dr Jennifer Kelley</b><br>jennifer.kelley@uwa.edu.au  | <p><b>3D camouflage in artificial moths.</b> Predators and prey interact in a 3D world, but few studies have considered whether visual depth cues play a role in camouflage. For example, butterflies and moths often have wing patterning that produces the illusion of 3D form, but it is not clear if these patterns function for camouflage. This study will investigate the effect of 3D background textures on the success of different 3D camouflage strategies using wild birds as predators and artificial patterned 'moth' targets. The project will involve fieldwork in local woodlands and will involve photography and image editing techniques.</p>  | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |

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| <b>Prof Gary Kendrick</b><br>gary.kendrick@uwa.edu.au<br><b>Dr Elizabeth Sinclair</b><br>elizabeth.sinclair@uwa.edu.au<br><b>Dr Matthew Fraser</b><br>matthew.fraser@uwa.edu.au   | <p><b>Seagrass adaptation and acclimation responses to extreme climatic events</b></p> <p>Extreme climatic events are predicted to become more frequent and severe, causing rapid ecosystem change. These extreme events can act as strong and acute agents of selection, generating widespread mortality and collapse of ecosystem services. Understanding how ecosystem engineers, such as seagrasses, respond to change will be a critical component of their management in the future. Shark Bay is a World Heritage Area with some of the largest seagrass meadows in the world. These meadows have high ecological, economic, and social values, supporting abundant and diverse animal communities. However, the large meadows formed by temperate seagrass species are directly threatened by climate change, underlined by large-scale dieback following a marine heatwave event in 2011. This project will focus on plant growth and physiological responses to environmental stressors associated with extreme events under predicted climate change scenarios. Experiments will be conducted in growth tanks with sampling to quantify physiological and genomic stress responses.</p> | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Prof Hans Lambers</b><br>hans.lambers@uwa.edu.au<br><b>Asst/Prof Matthias Leopold</b><br>matthias.leopold@uwa.edu.au<br><b>Dr Kosala Ranathunge</b><br>kosala.ranathunge@uwa.edu.au<br><b>Dr Hongtao Zhong</b><br>hongtao.zhong@uwa.edu.au | <p><b>Phytogeography of Declared Rare Flora species at Great Brixton Street Wetland or Alison Baird Reserve?</b></p> <p>The Great Brixton Street Wetland, located in the Perth metropolitan, however harbors an extraordinary high biodiversity within the Swan Coastal Plain. The long-term interactions between alluvial/colluvial inputs from Darling Range on the east and coast sand dune development from the west have given this seasonal wetland area a unique combination of geography and hydrology. These significantly contribute to the existence of such biodiversity, and provide a fortunate ecological niche for many rare flora species. Some species only restricted to certain areas, but why? The potential Honours or Masters project are aimed to answer this. Field and glasshouse experiments will be conducted to investigate the distribution of selected rare flora species in relation to soil and water resources.</p>  | <b>Honours</b><br><b>Masters</b>               |
| <b>E/Prof Hans Lambers</b><br>hans.lambers@uwa.edu.au<br><b>Assoc/Prof Patrick Finnegan</b><br>patrick.finnegan@uwa.edu.au<br><b>Dr Kosala Ranathunge</b><br>kosala.ranathunge@uwa.edu.au   | <p><b>Why do Fabaceae, Myrtaceae and Proteaceae co-dominate on the most nutrient impoverished soils on earth?</b></p> <p>The soils of southwestern Australia are among some of the oldest and most nutrient impoverished soils on earth. They support a hyper-diverse flora that is dominated by species from three families - Fabaceae, Myrtaceae and Proteaceae. We know much about the specific adaptations that allow the Proteaceae to live on these soils, such as cluster roots that mobilise phosphate, highly proficient phosphorus remobilisation from leaves and roots, low levels of ribosomal RNA and phospholipids in leaves, delayed greening in young leaves, preferential allocation of phosphorus to photosynthetic cells, among others. By comparison, we know very little about the adaptations that allow Fabaceae and Myrtaceae to co-dominate. This project will focus on plants in Alison Baird Reserve in Perth to investigate the ecophysiological and physiological adaptations in leaves and roots that allow members of these families to live in nutrient poor environments.</p>   | <b>Honours</b><br><b>Masters</b>               |
| <b>Dr Tim Langlois,</b><br>tim.langlois@uwa.edu.au<br><b>Shaun Wilson</b><br>shaun.wilson@dbca.wa.gov.au<br><b>Thomas Holmes</b><br>thomas.holmes@dbca.wa.gov.au  | <p><b>What drives change in size spectra of fish assemblages?</b></p> <p>The structure of fish assemblages is influenced by both fishing pressure and habitat. Increased fishing typically removes large predatory species and allows proliferation of smaller bodied fish, whilst changes in structural complexity alter availability of refuge space for different sized fish. Consequently, the size distribution of fish assemblages can be linked to changes in both fishing pressure and habitat. On coral reefs habitat structure and complexity is often governed by the size and composition of the coral colonies which is also indicative of reef status with respect to disturbance history. This project will use information from stereo video to assess how the size distribution of fish and coral assemblages relate to each other. Using surveys from fished and unfished reefs and across reefs with different coral communities, the project will also explore the relative importance of fishing and habitat on the size distribution of fish.</p>  | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Dr Tim Langlois,</b><br>tim.langlois@uwa.edu.au<br><b>Dr. Matt Navarro</b><br>matthew.navarro@uwa.edu.au<br><b>Dr. Jacquomo Monk</b><br>jacquomo.monk@utas.edu.au  | <p><b>Monitoring highly targeted mesophotic fish populations: optimising stereo-video monitoring of large offshore no-take marine reserves</b></p> <p>Large offshore no-take marine reserves have recently been created around Australia and New Zealand. This project will involve field work to collect baited remote stereo-video samples within no-take areas within the Ningaloo and South-west Capes region. Existing data sets will be provided from New Zealand. This project will use novel methods of power analysis to design optimal future monitoring plans to detect differences in highly targeted mesophotic grouper populations (e.g. hāpuku <i>Polypriion oxygeneios</i> ) that may occur after the cessation of fishing. The student will develop skills in field work and novel statistical analyses applicable to marine park monitoring design.</p>  | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |

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| <p><b>Dr Craig Lawrence</b><br/>craig.lawrence@dpird.wa.gov.au</p> <p><b>Dr Justin Blythe</b><br/>justin.blhythe@watercorporation.com.au</p> <p><b>Assoc Prof Julian Partridge</b><br/>julian.partridge@uwa.edu.au</p> <p><b>Prof Phil Vercoe</b><br/>philip.vercoe@uwa.edu.au</p> | <p><b>Using fish as biosentinels to protect our drinking water supply</b><br/>This is a collaborative project between UWA, DPIRD and Water Corporation to trial a biological-based early warning monitoring system which uses fish as bioindicators of water quality. The system employs video surveillance together with data analyses to monitor changes in fish behaviour in response to varying water quality conditions. In this project anaesthesia will be used to mimic changes in fish behaviour due to either accidental (i.e. chemical spill) or intentional (i.e. terrorism) contamination (UWA AEC approval has already been obtained for this project). This project will result in an early warning system to protect Perth's drinking water supplies.</p>   | <p><b>Honours</b></p>                    |
| <p><b>Prof Jessica Meeuwig</b><br/>jessica.meeuwig@uwa.edu.au</p>  | <p><b>Changes in scale of coral bleaching in the British Indian Ocean Territory.</b><br/>The 2016 El Nino swept the world's oceans causing unprecedented rates of coral bleaching globally. Reports in October 2016 suggest that 80% of corals in the northern Great Barrier Reef are dead as a result of this warming event. Some evidence suggests that corals recover from bleaching faster when in fully protected marine protected areas (MPA). As part of a fish survey using baited remote underwater video systems (BRUVS) we have habitat data from the British Indian Ocean Territory MPA pre and post the 2016 bleaching event. This project would examine (1) whether BRUVS be used to detect bleaching and (2) the chance in incidence rate of bleaching pre event and at two points post bleaching.</p> | <p><b>Honours</b></p>                    |
| <p><b>Professor Jessica Meeuwig</b><br/>jessica.meeuwig@uwa.edu.au</p>   | <p><b>Detecting coral bleaching from baited remote underwater visual imagery</b><br/>Assessment of coral bleaching largely relies on either aerial surveys of <i>in situ</i> underwater visual census. Our large data set of baited remote underwater video systems (BRUVS) provides an opportunity to score the scale of bleaching globally and also through time at key locations. This project involves developing a new technique for quantifying bleaching based on BRUVS and analysing spatial and temporal patterns.</p>   | <p><b>Masters</b></p>                    |
| <p><b>Professor Jessica Meeuwig</b><br/>jessica.meeuwig@uwa.edu.au</p>   | <p><b>Environmental DNA in pelagic environments</b><br/>This project would develop a protocol for obtaining eDNA samples in Western Australia for pelagic species, that would include contributing to a global library of bar codes for pelagic species.</p>  | <p><b>Masters</b><br/><b>PhD</b></p>     |
| <p><b>Prof Jessica Meeuwig</b><br/>jessica.meeuwig@uwa.edu.au</p> <p><b>Prof Christine Erbe</b> (Curtin)</p>   | <p><b>Cross-shelf patterns in fish biodiversity at Bremer Basin.</b><br/>The Bremer Basin has been identified as a "hotspot" of diversity, supporting an iconic aggregation of orcas. The degree to which this area also is a hotspot for area is a fish hotspot is however unknown. Towed video imagery has been collected at numerous locations in the area and this project will focus on (1) assessing the information generated by towed video and (2) interpreting this in terms of regional diversity.</p>   | <p><b>Honours</b></p>                    |
| <p><b>Dr Matt Navarro,</b><br/>matthew.navarro@uwa.edu.au</p> <p><b>Dr Tim Langlois</b><br/>tim.langlois@uwa.edu.au</p> <p><b>Dr Dave Fairclough</b><br/>David.Fairclough@fish.wa.gov.au</p>   | <p><b>Designing recreational fishing policies using representative fisher preferences</b><br/>Whilst recreational fishing policies are designed to meet biological based management objectives, fishers preferences are also incorporated into these decisions. At present there is a lack of transparency about how these preferences are measured and accounted for. This study will test the use of an economic technique known as choice experiments to measure fishers' preferences for suites of management interventions including bag limits, seasonal closures and size limits and attempt to combine these preferences with biological based management strategy evaluations to generate recommendations for policy interventions.</p>  | <p><b>Honours</b><br/><b>Masters</b></p> |
| <p><b>Dr Matt Navarro,</b><br/>matthew.navarro@uwa.edu.au</p> <p><b>Dr Tim Langlois</b><br/>tim.langlois@uwa.edu.au</p> <p><b>Dr. Jacquomo Monk</b><br/>jacquomo.monk@utas.edu.au</p>  | <p><b>Spatial usage of the Australian Marine Parks network</b><br/>In 2019 44 new marine parks were implemented in offshore commonwealth waters around Australia as part of the Australian Marine Parks network. At present little is known about how boat based fishers and non-fishing recreators are using these areas. This project will analyse existing data and collect new data on spatial usage patterns at boat ramps adjacent to 13 of these new marine parks. These usage patterns will form baselines in Parks Australia's social and economic monitoring program and inform the planned 10 year review of the marine parks zoning.</p>  | <p><b>Honours</b><br/><b>Masters</b></p> |

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| <b>Dr Harriet Paterson</b><br>harriet.paterson@uwa.edu.au<br><b>Dr Renae Hovey</b><br>renae.hovey@uwa.edu.au              | <b>Plastics in the regurgitated content from sea birds from Lancelin, Western Australia</b><br>A number of Brown Noddies were recently banded in Lancelin Western Australia and during the process the birds regurgitated their food which consisted of whole fish. A number of samples were collected and have been stored for chemical analysis, with particular focus on the presence and composition of plastic fibres. This project will process and analyse these fish which will give us some insight into the levels of plastic pollution that sea birds are exposed to in their feeding grounds off the continental shelf of Western Australia.   | <b>Honours<br/>Masters</b>         |
| <b>Dr Giovanni Polverino</b><br>giovanni.polverino@uwa.edu.au<br><br><b>A/Prof Jon Evans</b><br>jonathan.evans@uwa.edu.au | <b>Fitness consequences of personality in guppies and mosquitofish</b><br>Boldness, aggressiveness, and exploration are three behavioural traits often considered in studies on animal personality. Despite the increasing interest in studying animal personality in the last few decades, we still know little about how variation in these traits is maintained within populations, and, in particular, the reproductive outcome of individuals differing in those traits. This project will test whether fish that invest more in dominance behaviours and searching for mates have a higher fitness return than others when living in social groups. We expect bolder/dominant males producing more offspring and females producing clutches more genetically diverse (multiple paternity).   | <b>Honours</b>                     |
| <b>Dr Giovanni Polverino</b><br>giovanni.polverino@uwa.edu.au<br><br><b>A/Prof Jon Evans</b><br>jonathan.evans@uwa.edu.au | <b>Links between plasticity traits in guppies and mosquitofish</b><br>Understanding causes and consequences of behavioural plasticity is a major focus in animal behaviour studies for its importance to any population's ability to persist under changing environments. However, behavioural plasticity in traits linked to reproduction has received surprisingly limited attention. This project will test whether male individuals maintained in isolation increase their investment in sperm traits and behaviour after exposure to adult females. We expect that exposure to females will result in higher sperm production, boldness, and aggressiveness towards rivals.   | <b>Honours</b>                     |
| <b>Dr Cristina E Ramalho</b><br>cristina.ramalho@uwa.edu.au   | <b>Biodiversity and human-nature connection considerations in urban forest management</b><br>Urban forests are vital for climate change adaptation and mitigation, human wellbeing, and biodiversity conservation in cities. Although socio-ecological values are normally identified as primary drivers of urban forest management, they are often not properly, if at all, taken into account in the actual decision-making process for tree species selection. This socio-ecological study aims to provide insight and guidance on how to better cater for biodiversity and human-nature connection values in urban forest management. A first component of this project will analyse how biodiversity and human-Nature connection values are considered in other cities located in global biodiversity hotspots. A second component of the project, will survey actors in urban forest management in the Perth Area to understand among others: 1) the biodiversity and social-ecological aspects that they perceive as relevant in urban forest management, 2) the challenges and dilemmas they face when trying to address those aspects in decision making, 3) how those aspects influence practical decision-making on the ground, and 4) the knowledge gaps perceived. Project of the Clean Air and Urban Landscapes hub.   | <b>Honours<br/>Masters<br/>PhD</b> |
| <b>Dr Cristina E Ramalho</b><br>cristina.ramalho@uwa.edu.au   | <b>Ecological benefits and functional gaps in native plant palettes commonly used in urban greening</b><br>Urban greening often relies on a limited pallet of native and non-native plants that are 'proven performers' and have a range of traits that makes them suitable for urban green spaces. While biodiversity conservation is normally presented as a key reason for the use of native plants, often little thought is put into what ecological functions may be provided by and which native fauna may benefit from a particular plant pallet. Urban plantings have the potential to provide several ecological functions to a variety of native bird, reptile, and arthropod functional guilds. However, the limited range of native plants likely means that their potential for biodiversity conservation is not fully realized. This study aims to understand the biodiversity conservation value of native plant pallets used in urban greening in the Perth Metropolitan Area, and how these pallets could be improved so to cater for a wider range of biodiversity values. The study examines 1) the native fauna functional guilds that are known to or that could use the urban environment (with focus on species with positive or neutral interactions with people); 2) the range of native plants commonly used in urban plantings and that are available in commercial nurseries, the ecological services they provide and the taxa and functions they support; 3) which functional groups are not supported by those plant pallets; 4) candidate species to fill the identified gaps, based on the analysis of local remnant plants, and plant lists provided by specialized native nurseries and volunteering groups (WA Wildflower Society and Friends of Kings Park). Project in collaboration between the Clean Air and Urban Landscapes hub and Kings Park Science | <b>Honours<br/>Masters<br/>PhD</b> |

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| <p><b>Dr Kosala Ranathunge</b><br/>kosala.ranathunge@uwa.edu.au</p> <p><b>E/Prof Hans Lambers</b><br/>hans.lambers@uwa.edu.au</p> | <p><b>Understanding the traits of cluster- and non-cluster-roots in Proteaceae plants</b></p> <p>The ancient, highly-weathered and severely nutrient-impoverished landscapes of south-western Australia are home to an enormous diversity of vascular plants, and one of the world's hotspots for diversity of the Proteaceae family. The extremely low concentration of P in these soils is often unavailable to plant roots. Almost all Proteaceae are non-mycorrhizal. Instead, they develop 'cluster' roots that exude carboxylates, a remarkable morphological and physiological adaptation that chemically extracts P from P-impoverished soil. However, roots of plants usually undergo intense sealing, depositing suberin and lignin. These barriers protect roots against pathogens and they also have antifungal properties. However, successful carboxylate exudation by cluster-roots of Proteaceae would require a lack of perfect sealing. Absence of perfect barriers would be risky for the plant, due to an increased exposure and vulnerability to pathogens. Do Proteaceae roots have other mechanisms to fight against pathogens? Why don't they have mycorrhizal colonisation? We will explore, how these roots maximise P acquisition and stress tolerance at anatomical, physiological, biochemical and genomic levels.</p> | <p><b>Honours</b><br/><b>Masters</b><br/><b>PhD</b></p> |
| <p><b>Dr Kosala Ranathunge</b><br/>kosala.ranathunge@uwa.edu.au</p>   | <p><b>Silicon and the plant cell wall matrix</b></p> <p>Silicon (Si) is one of the most abundant elements on earth. Although it is not considered as a plant nutrient essential for the plant growth and development, it is known to enhance growth and yield of rice plants, a well-known commelinoid monocotyledonous Si-accumulator. However the molecular details explaining the role of Si on cell wall growth is unknown. Presumably it is due to biosilification of cellulosic and non-cellulosic polysaccharides, lignin and proteins. In addition, it has also been shown that Si has a protective role against abiotic stress tolerance, specifically against toxic ions such as Na<sup>+</sup> under salinity stress. Since Na<sup>+</sup> transport in rice is known to be mainly apoplastic (extracellular matrix), predominantly through the cell walls bypassing suberised and lignified barriers, Si may have an important role in blocking apoplastic Na<sup>+</sup> transport into the stele. This project will investigate how Si can diminish Na<sup>+</sup> uptake in roots of rice using anatomical, biochemical, physiological and molecular biological techniques.</p>  | <p><b>Honours</b><br/><b>Masters</b><br/><b>PhD</b></p> |
| <p><b>Dr Michael Renton</b><br/>michael.renton@uwa.edu.au</p> <p><b>Dr Francois Teste</b><br/>francois.teste@uwa.edu.au</p>       | <p><b>Evolution and ecology of plant-fungal interactions during invasion</b></p> <p>Most invasive trees depend closely on mycorrhizal symbionts to provide required resources, and thus their invasive success depends on the dispersal of these symbionts as well as their own dispersal. Invasive trees may also be negatively impacted by pathogenic fungi in their natural range, and thus benefit from 'enemy release' if they spread into new areas faster than these pathogenic fungi. Previous empirical and theoretical work has shown that the dispersal characteristics of organisms can undergo selection pressure and evolution during the course of an invasion or colonization of new areas, but the evolutionary dynamics of dispersal during co-invasion has not been considered. This project will use spatially-explicit eco-evolutionary simulation modelling to investigate how the dispersal characteristics of trees and their mycorrhizal symbionts and pathogens evolve over the course of a tree invasion, and how management that accounts for both evolution and ecology can help slow tree invasions and protect natural environments. Applicants do not need prior modelling experience, but should be passionate about ecology and evolution.</p>  | <p><b>Honours</b><br/><b>Masters</b></p>                |
| <p><b>Dr Michael Renton</b><br/>michael.renton@uwa.edu.au</p> <p><b>Dr Pieter Poot</b><br/>pieter.poot@uwa.edu.au</p>             | <p><b>Evolution of rooting strategies</b></p> <p>Plants use their roots to forage for the water and nutrients they need to survive and reproduce. Different rooting strategies evolve in different conditions, to enable plants to find these resources as efficiently as possible. This project will use eco-evolutionary models that simulate populations and communities of plants with detailed three-dimensional root structures evolving over time. This modelling can address big questions such as the costs and benefits of phenotypic plasticity, the uniqueness or repeatability of evolution, the drivers of diversity in plant communities, and the processes that lead to the creation of new species. Applicants do not need prior modelling experience, but should be passionate about ecology and evolution.</p>   | <p><b>Honours</b><br/><b>Masters</b></p>                |

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| <p><b>Dr Michael Renton</b><br/>michael.renton@uwa.edu.au</p>   | <p><b>Ecological and Evolutionary Modelling for Agriculture and Conservation</b><br/>Modelling can be an essential tool for understanding, predicting and managing many aspects of ecological, evolutionary and agricultural systems. Ecological models can be used to address practical and theoretical questions such as:<br/>           - How do plants and animals evolve optimal strategies to find, compete for, and share the resources they need to survive and reproduce, in variable and changing environments?<br/>           - How can we maintain global food security by stopping weeds and pests evolving resistance to pesticides?<br/>           - What is the best way to search for and manage invasive organisms that threaten our agricultural industries and natural resources?<br/>           - How do interactions among the individual organisms in ecological communities affect the diversity, stability and resilience of these communities?<br/>           If you are interested in learning more about ecological and evolutionary modelling, and applying it to important practical or theoretical issues, then please get in contact.</p>   | <p><b>Masters</b><br/><b>PhD</b></p>                    |
| <p><b>Dr Abbie Rogers,</b><br/><b>Dr Belinda Cannell,</b><br/><b>Michael Burton</b><br/>belinda.cannell@uwa.edu.au</p>  | <p><b>Prof</b><br/><b>How big is the value of a little penguin?</b><br/>Little penguins are the smallest penguin species. Their largest breeding colony in Western Australia is just off the shore of Rockingham, in the Perth metropolitan region. They face many threats given their co-location with a major human population base, including marine and coastal developments, predation, watercraft strikes, and pressures from eco-tourism. To balance the benefits and costs of coastal activities with the benefits and costs of conserving little penguins, decision makers need to identify what the value of the penguin colony is. This project will involve developing a non-market valuation survey to estimate how much people are willing to pay to protect little penguins through improved management outcomes. Applicants will need to have a background in economics (e.g. units in microeconomic theory, environmental and resource economics) or strong skills in statistical analyses.</p>  | <p><b>Honours</b><br/><b>Masters</b></p>                |
| <p><b>Assoc Prof Amanda Ridley</b></p>  | <p>Understanding the relationship between cooperation communication and cognition. My research lab uses habituated groups of free-living cooperatively breeding Western Australian magpies to ask questions primarily focussed in the field of behavioural ecology. Students are expected to conduct fieldwork on one of the following topics: the benefits and dynamics of cooperation (group-living behaviour), patterns of communication, and causes of variation in cognition. My research lab also looks at research in relation to the impacts of anthropogenic noise on vocal communication, and heat stress effects on animal behaviour (in terms of the impact of heatwaves and increasingly high temperatures on wild animal behaviour). Students applying to my lab should be interested in a project in one of these research areas. I have not posted a specific project here, since there is scope for several research projects depending on the specific interests of the student. The magpies are ringed for individual identification, and can be observed from a distance of a few metres without alteration in their behaviour. The study sites are based within urban Perth. Students will need access to reliable transport, and to have a full driver's license.</p> | <p><b>PhD</b><br/><b>Honours</b><br/><b>Masters</b></p> |
| <p><b>Dr Ana M M Sequeira (UWA)</b><br/>ana.sequeira@uwa.edu.au<br/><b>Dr Matthew Fraser (UWA)</b><br/>matthew.fraser@uwa.edu.au<br/><b>Prof Gary Kendrick (UWA)</b><br/>gary.kendrick@uwa.edu.au</p> | <p><b>Ecological links between coastal habitats and marine megafauna conservation</b><br/>The 2011 Western Australian marine heatwave associated with global climate change has strongly affected the Shark Bay World Heritage Area, known for its extensive seagrass meadows and unique marine megafauna. The aftermath of this heat wave highlighted that strong links exist between the habitat-forming dominant temperate seagrass, <i>Amphibolis antarctica</i>, in Shark Bay and the health and abundance of marine megafauna, such as green turtles and dugongs. Understanding these ecological links is crucial to predicting the effects of predicted seagrass loss in Shark Bay on the populations of marine megafauna species that contribute to its World Heritage status. This project will be a collaboration between UWA and DBCA and will be most suitable for a student passionate about remote iconic areas in the Western Australia coastline and with strong interest in investigating behaviour and movement of marine megafauna in relation to coastal habitats.</p>  | <p><b>PhD</b><br/><b>Honours</b><br/><b>Masters</b></p> |

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| <p><b>Dr Ana M M Sequeira (UWA)</b><br/>ana.sequeira@uwa.edu.au</p> <p><b>Dr Matthew Fraser (UWA)</b><br/>matthew.fraser@uwa.edu.au</p> <p><b>Dr Hector Lozano-Montes (CSIRO)</b><br/>hector.lozano-montes@csiro.au</p> <p><b>Dr Ben Radford (AIMS)</b><br/>B.Radford@aims.gov.au</p> <p><b>Prof Gary Kendrick (UWA)</b><br/>gary.kendrick@uwa.edu.au</p> | <p><b>Understanding the iconic World Heritage Shark Bay using an ecosystem modelling framework</b></p> <p>Regional warming and extreme events such as the 2011 Western Australian marine heatwave associated with global climate change has promoted large ecosystem shifts to the marine ecosystem in the Shark Bay World Heritage Area including extensive loss of seagrasses, starvation in turtles and major effects on invertebrate fisheries and fish communities. Understanding how to predict and manage the impacts of climate change on marine ecosystems is a key emerging issue and it is imperative that we are prepared to effectively manage ecosystem scale shifts in Shark Bay to safeguard its World Heritage status. Extreme climatic events are predicted to increase in frequency, intensity and duration. Therefore, understanding the ecosystem impacts of water temperature changes and climate-related seagrass loss is particularly pertinent in ecosystems where foundation seagrasses grow near the edge of their biogeographical range, such as in Shark Bay. This project will pull together physical, habitat, and animal community data into an ecosystem modelling framework to examine physical and biological interactions in Shark Bay, and help predict the trajectory of this World Heritage Site under future climate scenarios.</p> <p>This project will be a collaboration between UWA, AIMS and CSIRO and will be most suitable for a student with strong interest in understanding ecological links within ecosystems and with interest to develop quantitative skills.</p> | <p><b>PhD</b><br/><b>Honours</b><br/><b>Masters</b></p> |
| <p><b>Professor Leigh Simmons</b><br/>leigh.simmons@uwa.edu.au</p>  | <p><b>Seminal fluid effects on female sexual receptivity</b></p> <p>There is considerable evidence that males will increase the numbers of sperm ejaculated in response to sperm competition risk, however the ejaculate also comprises a host of seminal fluid proteins that mediate sperm performance and subsequent fertilization success. Male crickets (<i>Teleogryllus oceanicus</i>) have been shown to adjust the protein composition of the seminal fluid in response to sperm competition risk. Seven seminal fluid protein genes were found to have an increased expression in males exposed to rival calls. However, the function of these seminal fluid proteins remains unknown. This project will use RNA-knockdown to determine whether proteins in the ejaculate affect a females future receptivity to mating.</p>   | <p><b>Honours</b><br/><b>Masters</b></p>                |
| <p><b>Professor Leigh Simmons</b><br/>leigh.simmons@uwa.edu.au</p>  | <p><b>Risk taking behaviour and residual reproductive value</b></p> <p>Animals are able to modify their behaviour in response to changes in their internal and environmental state. The asset-protection principle predicts that an animal's risk taking behaviour should vary as a result of its residual reproductive value (RRV); animals with greater RRV would incur a greater cost if injured or killed and should therefore take fewer risks than those with low RRV. Despite the intuitive appeal of this hypothesis, few studies have effectively separated the effects of RRV on behaviour from those of age. This project will test the widely invoked hypothesis by measuring the risk-taking behaviour of female Australian field crickets (<i>Teleogryllus oceanicus</i>) of the same age after manipulating their RRV by surgical removal of the ovaries.</p>   | <p><b>Honours</b> <b>Masters</b></p>                    |
| <p><b>Professor Leigh Simmons</b><br/>leigh.simmons@uwa.edu.au</p>  | <p><b>Sexual selection and sperm competition</b></p> <p>Research opportunities are available to explore the role of pre-copulatory and post-copulatory sexual selection in the evolution of male and female reproductive behaviour and morphology. We seek to understand how life-history trade-offs affect male allocation of resources to the weapons and ornaments of mating competition and sperm production for competitive fertilization success. These questions can be addressed in a variety of taxa from insects to humans, and using a variety of approaches, from comparative morphology to genetics.</p>  | <p><b>Honours</b><br/><b>Masters</b><br/><b>PhD</b></p> |
| <p><b>Professor Leigh Simmons</b><br/>leigh.simmons@uwa.edu.au</p>  | <p><b>The evolution of mating spurs in trapdoor spiders</b></p> <p>Many male trapdoor spiders use their front legs to move females into a suitable position during mating, by locking highly specialised mating spurs located on their anterior legs under the female's fangs during copulation. Using landmark geometric analyses, the project will quantify and map shape variation onto a pre-existing molecular phylogeny of the spiders, and test evolutionary hypotheses for the divergence of these male mating structures. The project will involve collaboration with the WA Museum.</p>  | <p><b>Honours</b><br/><b>Masters</b></p>                |

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| <b>Professor Leigh Simmons</b><br>leigh.simmons@uwa.edu.au<br><b>Dr Nikolai Tatarnic</b><br>nikolai.Tatarnic@museum.wa.gov.au  | <b>Traumatic insemination in plant bugs</b><br>In traumatic insemination (TI), males use hypodermic genitalia to inject sperm into the female through the side of her abdomen, bypassing her genitalia. This project will use plant bugs in the genus <i>Coridromius</i> to examine sexual conflict arising from TI. Experiments might include but are not limited to: determining the costs of TI to females; measuring the immune response of females to TI; studies of mating behaviour/mate choice; identifying the sperm pathway through the female bloodstream. The project will involve collaboration with researchers at the WA Museum.  | <b>Honours</b><br><b>Masters</b><br><b>PhD</b> |
| <b>Professor Leigh Simmons</b><br>leigh.simmons@uwa.edu.au<br><b>Dr. Jan Hemmi</b><br>jan.hemmi@uwa.edu.au   | <b>The costs of male weaponry: are males with enlarged weapons visually impaired</b><br>Male dung beetles invest in horns which are used in battles over access to tunnels and the females breeding within. However, some males do not develop horns or fight for access to females, but rather sneak copulations guarded by horned males. Males that develop horns compromise the development of their eyes. This project will compare the visual capabilities of minor and major males using a combination of anatomical, physiological and behavioural methods. You will learn how to make electroretinogram measurements to assess the beetles' visual acuity and light sensitivity and correlate these findings with anatomical predictions based on 3D microCT measurements of the beetles' eyes.  | <b>Honours</b>                                 |
| <b>Prof Leigh Simmons</b><br>leigh.simmons@uwa.edu.au<br><br><b>Dr Tim Langlois,</b><br>tim.langlois@uwa.edu.au<br><br><b>Dr Simon de Lestang</b><br>simon.deLestang@fish.wa.gov.au<br><br><b>Dr Jason How</b><br>jason.how@fish.wa.gov.au | <b>Fertilization ecology and implications of sperm limitation in the western rock lobster</b><br>The western rock lobster fishery is the highest value single species fishery in Australia, worth over \$400 Million per annum. Very little is known about the occurrence of sperm limitation for the fertilization ecology of western rock lobster, however it is assumed that the selective removal of larger males from the fishery could result in the occurrence of sperm limitation. This study will involve conducting mating trials to establish the mechanics of fertilization within western rock lobster. In addition, both laboratory and field investigations will be used to investigate the relationship between sperm abundance and spermatophore size, using methods to count sperm isolated from spermatophores and relate this data to field surveys of spermatophore size across areas of the fishery with contrasting adult body-size distribution. | <b>Honours</b><br><b>Masters</b>               |
| <b>Dr Greg Skrzypek</b><br>grzegorz.skrzypek@uwa.edu.au<br><br><b>Dr Mat Vanderklif</b><br>mat.vanderklift@csiro.au  | <b>Ecology of feral predators at Ningaloo:</b><br>Feral cats and foxes are a threat to fauna along the Northwest Cape, including to hatchling turtles. This project will work with DBCA (Department of Biodiversity, Conservation and Attractions Western Australia) to understand what these predators eat, and will use the stable nitrogen and carbon isotopes and stomach content. This is a collaborative project with CSIRO.   | <b>Masters</b>                                 |
| <b>Greg Skrzypek</b><br>Grzegorz.Skrzypek@uwa.edu.au<br><b>Brad Degens (DWER)</b>  | <b>Stable sulfur isotope composition as a tracer of nutrients runoff form agrosystems.</b> This research project is using a unique stable isotope tracer to estimate sulfur budget in ecosystems downstream from a farm testing a new type of product limiting phosphorus leaching. This new product contains gypsum produced through neutralization of mine waste. A unique stable sulfur isotope composition will be distinguishable in soil, water, and plants. The project will include fieldwork and lab experiments. The project is supported by the Department of Water and Environmental Regulation (DWER) and will also offer the opportunity to experience fieldwork for the collection of samples in the Mandurah region with DWER team.  | <b>Honours</b><br><b>Masters</b>               |
| <b>Ruchira Somaweera</b><br>ruchira.somaweera@csiro.au<br><br><b>Bruce Webber</b><br>bruce.webber@csiro.au<br>bruce.webber@uwa.edu.au  | <b>Mitigating global change impacts on vertebrate conservation outcomes</b><br>Global environmental change drivers, including landscape fragmentation, urbanisation, climate change and invasive alien species, represent a significant threat to the resilience of terrestrial vertebrates, as well as the roles they play in ecosystem stability. Urban and island environments represent some of the most impacted and fragile ecosystems, yet we know little about how global change threats play out in these settings and their impact on ecosystem interactions. Projects are available that take an integrated approach to finding conservation solutions, combining traditional empirical field ecology with new technology to investigate population ecology questions.  | <b>Honours</b> <b>Masters</b><br><b>PhD</b>    |

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| <b>Assoc. Prof Erik Veneklaas</b><br>erik.veneklaas@uwa.edu.au<br><br><b>Dr Paul Drake</b><br>paul.drake@uwa.edu.au  | <b>Water and CO<sub>2</sub> transport in relation to stomatal distribution</b><br>Why do fast-growing crops and drought-tolerant trees, very different plant types, have pores on both sides of their leaves, when the vast majority of plants don't? This project aims to assess the (dis)advantages of having stomata (leaf pores bound by guard cells) on both leaf sides (amphistomaty), rather than on one side (hypostomaty), and determine how these traits relate to the leaf's specific micro-climate. This knowledge will provide novel insights into the functional diversity of plants, direct plant breeding targets and contribute to the fundamental understanding of plant transpiration and photosynthesis, two processes that regulate the global exchange of water, CO <sub>2</sub> and energy.   | <b>Honours Masters</b>     |
| <b>Assoc. Prof Erik Veneklaas</b><br>erik.veneklaas@uwa.edu.au<br><b>Paul Drake</b><br>paul.drake@uwa.edu.au   | <b>How does vegetation affect the water balance on mine waste rock dumps?</b><br>Vegetation on mine waste rock dumps is not only a legal requirement but also provides "ecosystem services". On waste dumps where net percolation is undesirable because of toxic material, plant transpiration helps create a favourable "store-and- release" function. This line of research aims at determining the ideal mix of water use behaviours and drought tolerance levels in plant species, as dependent on substrate properties and climate. Projects may have an emphasis on transpiration, root water uptake, hydraulics, etc.  | <b>Honours Masters PhD</b> |
| <b>Assoc. Prof Erik Veneklaas</b><br>erik.veneklaas@uwa.edu.au<br><b>Fiamma Riviera</b><br>fiamma.riviera@uwa.edu.au<br><b>Justin Valliere</b><br>justin.valliere@uwa.edu.au         | <b>Ecophysiological research to support mine-site restoration</b><br>Restoring a diverse plant community on post-mining sites in WA is challenging our understanding of what substrate and climatic conditions plants need and tolerate. Ecophysiology can help to identify the drivers of species success in plant establishment, growth and survival. Ongoing research addresses issues of plant nutrition, plant water relations, heat tolerance etc. in relation to soils, climate, seed provenance, management and other relevant factors. Our projects use traditional and novel technology in plant physiology to measure plant traits and plant condition. This includes gas exchange, hydraulics, spectral and thermal sensing and several other field and lab methods. Projects on plant-plant, plant-microbe and plant-pathogen interactions are also possible. | <b>Honours Masters</b>     |
| <b>Assoc. Prof Erik Veneklaas</b><br>erik.veneklaas@uwa.edu.au<br><b>Dr Greg Skrzypek</b><br>grzegorz.skrzypek@uwa.edu.au<br><b>Dr Gavan McGrath</b><br>gavan.mcgrath@dbca.wa.gov.au | <b>Water sourcing of plants in a Swan River saltmarsh</b><br>Ashfield Flats is a threatened temperate coastal saltmarsh in the Perth Metropolitan Area. Changes are expected in the local hydrology of the site, due to likely modifications to urban drainage and due to climate change. Improved knowledge of the water dynamics at the site and the use of different water sources (depth, salinity etc.) by vegetation is needed. This project, supported by DBCA, involves experimental research in a controlled environment to test methodology for field studies. The project has elements of plant physiology, soil science, and isotope biogeochemistry, and will include measurements as well as some modelling.   | <b>Honours Masters</b>     |
| <b>Assoc. Prof Erik Veneklaas</b><br>erik.veneklaas@uwa.edu.au<br><b>Dr Carolyn Harding</b><br>carolyn.harding@dbca.wa.gov.au  | <b>Salinity and drought tolerance of samphires in a Swan river saltmarsh</b><br>Ashfield Flats is a threatened temperate coastal saltmarsh in the Perth Metropolitan Area. Changes are expected in the local hydrology of the site, due to likely modifications to urban drainage and due to climate change. Samphires are a characteristic element of salt marshes. Contrasting spatial distributions of the five species occurring at Ashfield Flats suggest that there is niche differentiation related to salinity and inundation regimes. This project, supported by DBCA, involves experimental research in a controlled environment to assess tolerance to salinity and inundation, which will assist with conservation efforts.  | <b>Honours Masters</b>     |
| <b>Assoc. Prof Erik Veneklaas</b><br>erik.veneklaas@uwa.edu.au   | <b>Plant water relations</b><br>Water is an essential but scarce resource for almost all plants in WA. We do fundamental and applied research to understand how plants maximise water uptake, minimise water loss, and optimise water use efficiency. The projects can be field or lab-based, and may focus on roots, stems, leaves or whole plants. Techniques include hydraulics, gas exchange (photosynthesis/transpiration), micrometeorology, microscopy, stable isotopes and others.   | <b>Honours Masters PhD</b> |

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| <p><b>Prof Erik Veneklaas</b><br/>erik.veneklaas@uwa.edu.au</p> <p><b>Dr Siegy Krauss</b><br/>siegy.krauss@dbca.wa.gov.au</p> <p><b>David Merritt</b><br/>david.merritt@dbca.wa.gov.au</p> <p><b>Michael Renton</b><br/>michael.renton@uwa.edu.au</p> <p><b>Suzanne Prober</b><br/>suzanne.prober@csiro.au</p> <p><b>Martin Breed</b><br/>martin.breed@flinders.edu.au</p> | <p><b>Optimising seed sourcing for effective ecological restoration</b><br/>As the demand for ecological restoration grows rapidly, there is an increasingly urgent need and responsibility to use native seed for restoration as efficiently as possible. Our project's broad goal is to derive seed sourcing solutions that improve restoration efficiency under current and future environmental conditions. Specifically, we seek to comprehensively assess whether predictive sourcing for climate change increases restoration success. We are pursuing our aims by integrating cutting-edge approaches in plant physiology, seed biology, soil science, and plant genomics with experiments embedded within post-mining rehabilitation sites. Experimental trials in the glasshouse and seed lab will explicitly address hypotheses on provenance fitness and environmental factors for key restoration species of banksia woodlands to determine a mechanistic understanding of provenance related variation in adaptation. In particular, we seek to identify how provenances differ in their capacity to respond to environmental stressors associated with climate change (such as moisture and temperature), and the thresholds for different provenances. These experiments will help to attribute genetic differences observed in field trials to climate effects rather than site effects. Expected outcomes include clear seed-sourcing solutions for better restoration in a climate-change context. This research program is supported by an ARC linkage grant, with strong industry support from sand mining companies Hanson and Tronox.</p> | <p><b>Honours Masters</b><br/><b>PhD</b></p> |
| <p><b>Bruce Webber</b><br/>bruce.webber@csiro.au,<br/>bruce.webber@uwa.edu.au</p> <p><b>Martin Nunez</b><br/>martin.nunez@csiro.au<br/>nunezm@gmail.com</p> <p><b>Raphael Didham</b><br/>raphael.didham@uwa.edu.au<br/>raphael.didham@csiro.au</p>   | <p><b>Identifying vulnerabilities to improve the management of threatening weeds.</b><br/>Improvements in weed management can be achieved through a greater understanding of the population ecology of the species in question, as well as its plant ecophysiology and plant-ecosystem interactions. Niche theory can then be applied to identifying vulnerabilities to target for improved control. Projects are available, depending on the interests of the applicant, including controlled condition studies in Perth, as well as fieldwork in exotic locations across WA, interstate and overseas</p>   | <p><b>Masters</b><br/><b>PhD</b></p>         |
| <p><b>Bruce Webber</b><br/>bruce.webber@csiro.au<br/>bruce.webber@uwa.edu.au</p>   | <p><b>A taxonomic revision of <i>Ryparosa</i> (Achariaceae)</b><br/><i>Ryparosa</i> is a genus of understorey trees from tropical rainforests across South East Asia and Malesia, comprising approximately 25 described species. The genus has the potential to become a model species for understanding plant-animal interactions, including seed dispersal mutualisms and ant-plant interactions and plant defence mechanisms. Currently, however, taxonomic resolution in the genus remains unclear. Through a collaboration with Kew Gardens, this project aims to provide that clarity via a morphometric and molecular approach using a large collection of specimens as well as targeted additional sampling.</p>   | <p><b>PhD</b></p>                            |
| <p><b>Thomas Wernberg</b><br/>thomas.wernberg@uwa.edu.au,<br/>wernberglab.org</p>  | <p><b>Developing a novel restoration tool for threatened kelp forests</b><br/>Human-driven impacts on our oceans are intensifying and there is urgent need for novel solutions to combat habitat loss and promote resilience in marine ecosystems. In warmer margins of their range kelp forests are being replaced by algal turfs. This project will develop and test a novel restoration tool 'green gravel' and evaluate its ability to restore kelp forests in Australia. Green gravel involves seeding kelp spores onto pebbles, where they grow into small sporophytes that can be scattered across an impacted area. This tool could be effective at overcoming reinforcing feedbacks (propagule and recruitment limitation) that prevent recovery of kelp forests after shifts to turf. This is a collaborative project between UWA and the NSW Department of Primary Industries</p>   | <p><b>Honours</b><br/><b>Masters</b></p>     |
| <p><b>Thomas Wernberg</b><br/>thomas.wernberg@uwa.edu.au,<br/>wernberglab.org</p>  | <p><b>Thresholds for kelp forest loss and turf expansion.</b><br/>Pervasive habitat deterioration and destruction presents one of the biggest threats to species and global ecological function. There has been an accelerating loss of kelp forests globally, and an associated rise and persistence of degraded seascapes of sediment-laden algal 'turfs'. This project will conduct field experiments on kelp and turf reefs across different environments to identify thresholds for collapse and mechanisms for recovery. Advances here will improve how we understand the stability of these marine habitats, and the reversibility of sudden changes in the context of ongoing climate change. This is a collaborative project between UWA and the NSW Department of Primary Industries.</p>  | <p><b>Honours</b><br/><b>Masters</b></p>     |

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| <b>Thomas Wernberg</b><br>thomas.wernberg@uwa.edu.au,<br>wernberglab.org  | <p><b>Novel intervention-based solutions using strong genotypes to boost resistance or restore threatened kelp forests</b></p> <p>Research on marine habitat loss has mainly focused on negative impacts and declining performance of foundation species, and the effectiveness of passive strategies for recovery (e.g. marine reserves). Instead, an innovative approach targets individuals and areas that perform well under stress ('bright spots') to discover mechanisms, traits and active interventions that promote persistence. This project will use cutting edge genetic analyses to identify strong genotypes in natural 'bright spots' where surviving kelps have resisted or adapted to degraded conditions. This will provide a foundation to develop innovative proactive restoration and conservation solutions to breed resistance or promote recovery of degraded systems. This is a collaborative project between UWA and the NSW Department of Primary Industries.</p>  | <b>Honours<br/>Masters</b> |
| <b>Dr Dan White</b><br>daniel.white@uwa.edu.au  | <p><b>Conservation genetics and population modelling to secure wild populations of the Shark Bay mouse</b></p> <p>Australia currently has the world's greatest mammal extinction rate - since the arrival of Europeans there have been 29 recorded extinctions. This can be explained by habitat reduction and fragmentation, predation by damaging invasive predators such as cats and foxes and the ongoing impact of climate change. In response the Department of Biodiversity, Conservation and Attractions of WA (DBCA) has initiated an exciting and ambitious project to return the flora and fauna of Dirk Hartog Island (DHI) to what it was before the arrival of Europeans in 1616.</p> <p>This project provides an opportunity to help inform management of populations of the Vulnerable (IUCN, EPBC Act) Shark Bay mouse (<i>Pseudomys fieldi</i>). In collaboration with DBCA and the Australian Wildlife Conservancy, you will be working with genome-wide SNP data to help understand the current diversity that exists within the remnant population on Bernier Island, reintroduced population on Faure Island and introduced population on North West Island (Montebello islands). You will incorporate these data into population viability analysis models to predict extinction probabilities of remaining populations, as well as design translocation scenarios for successful establishment on DHI.</p> <p>This project would suit someone with experience in, or knowledge of, population genetic analyses and with an interest in population modelling. You will be working closely with DBCA so that your work has most impact and direct uptake for effective and dynamic conservation management, ultimately to ensure a sustainable future for one of Australia's most charismatic rodents. Visits to the islands to help with monitoring and to learn more about the context of the project can be arranged, likely in March/April and also possibly in September.</p> |                            |
| <b>Professor Philip Withers</b><br>philip.withers@uwa.edu.au<br><br><b>Dr. Christine Cooper</b><br>c.cooper@curtin.edu.au | <p><b>What controls insensible evaporative water of mammals and birds?</b></p> <p>The insensible evaporative water loss (non-thermoregulatory evaporative water loss, EWL) has traditionally been considered to be a passive biophysical process, not under physiological control, but we have recently shown that it is regulated by mammals (dasyurid marsupials) and birds (parrots). This project will measure the effect of ambient relative humidity on the insensible EWL of a mammal or bird, and investigate the biological control of its regulation, either water conservation at low humidities or facilitation of thermoregulation at high humidities.</p>  | <b>Honours<br/>Masters</b> |
| <b>Professor Philip Withers</b><br>philip.withers@uwa.edu.au<br><br><b>Dr. Christine Cooper</b><br>c.cooper@curtin.edu.au | <p><b>Comparison of thermal imaging and spot-lighting as tools for nocturnal mammal surveys</b></p> <p>Environmental researchers have typically used spotlights or head torches as the primary technique for non-invasive fauna observations and surveys of nocturnal fauna. In recent years, thermal technology has advanced and there are now commercially available high quality thermal scopes. But, are they as good as a spotlight or a head torch in determining abundance, based on distance sampling (now widely used to determine relative abundance based on transect searches). Distance sampling techniques will be used to test the comparative efficacy of these relatively new thermal imagery devices compared with traditional spotlighting in relatively open areas (e.g. pastures) and in open Banksia and eucalypt woodlands, which are both typically found on the Swan Coastal Plain. The project will involve collaboration with a local environmental consulting company.</p>   | <b>Honours<br/>Masters</b> |

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| <p><b>Prof Phillip Withers</b><br/>phillip.withers@uwa.edu.au</p> <p><b>Graham Thompson</b><br/>graham.thompson@uwa.edu.au</p> <p><b>Christine Cooper</b><br/>christine.cooper@uwa.edu.au</p>  | <p><b>Dr</b></p> <p><b>Assessing the efficacy of camera traps for fauna surveys</b><br/>Camera traps are now widely used in vertebrate fauna surveys and monitoring programs. There is a general assumption that these traps are a reliable and valid tool that record all or at least a majority of mammals that pass through the detection zone. However, some literature suggests that camera traps are not as reliable as many users believe, and modification of camera settings can improve detection sensitivity from 33% to 75%, including appreciable room for improvement. This research project will use 100 Reconyx (HC600) camera traps to test their efficiency to detect cat/fox sized mammals in a variety of orientations and settings. The outcome of this project has wide application for vertebrate fauna surveys, assessments and monitoring programs, and should interest a student that is intending to establish a career as a field zoologist that undertakes vertebrate fauna surveys. Equipment, advice and assistance for this project are available from experienced zoologists that routinely use camera traps as a detection and survey method.</p>   | <p><b>Honours</b><br/><b>Masters</b></p> |
| <p><b>Prof Phillip Withers</b><br/>phillip.withers@uwa.edu.au</p> <p><b>Sean Thomlinson</b><br/>sean.thomlinson@dbca.wa.gov.au</p> <p><b>Dr Christine Cooper</b><br/>christine.cooper@uwa.edu.au</p> <p><b>Amanda Bourne</b><br/>abourne.uct@gmail.com</p> | <p><b>Dr</b></p> <p><b>Validation of non-invasive measurement of energy and water turnover for birds</b><br/>Stable isotopes (doubly-labelled water, <math>2\text{H}_2\text{O}^{18}</math>) are now routinely used to measure energy and water turnover of free-living animals but the traditional protocol involves capture, injection of isotopes, blood sampling and recapture, which can be experimentally challenging especially for small birds. An alternative non-invasive approach is to administer the stable isotope mixture to free-living birds in food, and using faeces collected from birds to measure isotope turnover rates. This project will compare isotope turnovers for captive birds using both the traditional and non-invasive approaches to determine whether the non-invasive approach is feasible. We anticipate studying small bird species with varied diets (e.g. insectivorous, granivorous, nectarivorous).</p>   | <p><b>Honours</b><br/><b>Masters</b></p> |
| <p><b>Professor Dirk Zeller</b><br/>dirk.zeller@uwa.edu.au</p>   | <p><b>Fisheries in Indian Ocean Rim countries</b><br/>Science and policy on Indian Ocean fisheries are heavily skewed towards industrial tuna fisheries, yet most Indian Ocean Rim countries gain domestic food security, livelihoods and economic benefits from domestic non-tuna fisheries within their Exclusive Economic Zone waters. These coastal fisheries, however, are often heavily under-valued and under-represented in fisheries science at the national and regional level, as they are often dominated by marginalized small-scale fisheries with substantial data gaps. As part of the international Sea Around Us - Indian Ocean research initiative (<a href="http://www.seaaroundus-io.org">www.seaaroundus-io.org</a>), students will engage in country-level or ocean-basin scale aspects of fisheries science using big-data approaches. These types of projects could be especially interesting for students that are excited by data mining and historical ecology, or wish to be challenged by big-data approaches in an interdisciplinary setting. The Sea Around Us – Indian Ocean collaborates closely with the global Sea Around Us initiative (<a href="http://www.seaaroundus.org">www.seaaroundus.org</a>) and the interdisciplinary Global Fisheries Cluster (<a href="http://global-fc.oceans.ubc.ca/">http://global-fc.oceans.ubc.ca/</a>) at the University of British Columbia in Vancouver, Canada, and with FishBase (<a href="http://www.fishbase.org">www.fishbase.org</a>) and SeaLifeBase (<a href="http://www.sealifebase.org">www.sealifebase.org</a>) hosted in the Philippines. Most Sea Around Us research does not involve field-based data collection, as we emphasize the utility of pre-existing secondary data and databases for enhancement through data harmonization, data gap assessments and large-scale data approaches. An open and keen mind, critical thinking skills, team work abilities and a curiosity about fisheries data science is all that is required, but if you also have programming skills (e.g., R) or even advanced computing skills for big-data approaches .... all the better.</p> | <p><b>Masters</b><br/><b>PhD</b></p>     |