THE UNIVERSITY OF WESTERN AUSTRALIA

Student Research Projects 2021

School of Biological Sciences

WELCOME

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
Science Communication

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

FOR	NAME	EXT	EMAIL
EMERGENCIES	**EMERGENCY**	**2222**	**(24 hrs) (6488 2222 from ext ph)**
Maintenance Requests	Pauline Yeung	**2206/2545**	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 *Expense Claim Progress, Purchasing*	Science-Finance	-	purchasing-fsci@uwa.edu.au
HR *Contracts, Timesheets, Leave, Payroll, Misconduct*	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**	projects-sbs@uwa.edu.au
Fieldwork Applications	Supervisor / Tech Team	-	rick.roberts@uwa.edu.au
Diving & Boating	Warren Starr Rick Roberts	- **2225**	warren.starr@uwa.edu.au 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, *Card Access, Expense Claims, General Enquiries.*	Pauline Yeung	**2206** **2545**	admin-sbs@uwa.edu.au
General Administration Botany *Master keys Botany & Central, Card Access, Vehicle Bookings, General Enquiries*	Pauline Yeung	**2545**	admin-sbs@uwa.edu.au

MAJORS COORDINATORS

SPECIALISATION	COORDINATORS:	EMAIL:	EXT:
Botany	Pauline Grierson	Pauline.grierson@uwa.edu.au	7926
	Pieter Poot	Pieter.poot@uwa.edu.au	2491
Conservation Biology	Sam Setterfield	samantha.setterfield@uwa.edu.au	1926
	Pieter Poot	Pieter.poot@uwa.edu.au	2491
Science Communication	Heather Bray	Heather.bray@uwa.edu.au	2508
Marine Science	Renae Hovey	Renae.hovey@uwa.edu.au	2214
	Jane Prince	Jane.prince@uwa.edu.au	1469
Zoology	Jon Evans	Jonathan.evans@uwa.edu.au	2010
	Jason Kennington	Jason.kennington@uwa.edu.au	3233

HONOURS COORDINATORS

SPECIALISATION	COORDINATORS:	EMAIL:	EXT:
Botany	Jacqueline Batley	Jacqueline.batley@uwa.edu.au	5929
	Pauline Grierson	Pauline.grierson@uwa.edu.au	7926
Conservation Biology	Sam Setterfield	Samantha.setterfield@uwa.edu.au	1926
	Pieter Poot	Pieter.poot@uwa.edu.au	2491
Science Communication	Heather Bray	Heather.bray@uwa.edu.au	2508
Marine Science	Renae Hovey	Renae.hovey@uwa.edu.au	2214
	Jane Prince	Jane.prince@uwa.edu.au	1469
Zoology	Jan Hemmi	Jan.hemmi@uwa.edu.au	3117
	Mandy Ridley	Mandy.ridley@uwa.edu.au	3740
Research project coordinators	Jan Hemmi	Jan.hemmi@uwa.edu.au	3117
	Mandy Ridley	Mandy.ridley@uwa.edu.au	3740

MASTERS OF BIOLOGICAL SCIENCES
(Coursework and Coursework & Dissertation) - Specialisation Coordinators

SPECIALISATION	COORDINATORS:	EMAIL:	EXT:
Conservation Biology	Sam Setterfield	Samantha.setterfield@uwa.edu.au	1926
	Pieter Poot	Pieter.poot@uwa.edu.au	2491
Ecology	Pauline Grierson	Pauline.grierson@uwa.edu.au	7926
	Greg Skrzypek	Greg.skrzypek@uwa.edu.au	4584
Marine Biology	Renae Hovey	Renae.hovey@uwa.edu.au	2214
	Jane Prince	Jane.prince@uwa.edu.au	1469
Zoology	Jon Evans	Jonathan.evans@uwa.edu.au	2010
	Jason Kennington	Jason.kennington@uwa.edu.au	3233
Science Communication	Heather Bray	Heather.bray@uwa.edu.au	2508
Research project coordinators	Jan Hemmi	Jan.hemmi@uwa.edu.au	3117
	Mandy Ridley	Mandy.ridley@uwa.edu.au	3740

SUPERVISORS	TOPIC	LEVEL
Prof Jacqui Batley jacqueline.batley@uwa.edu.au	**Evolution of disease resistance genes** 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 Brassica species and wild relative species, perform comparative analysis within and between the species and provide an understanding of the evolution of these genes	**Honours** **Masters** **PhD**
Prof Jacqui Batley jacqueline.batley@uwa.edu.au **Dr Jing Li** jing.li@uwa.edu.au	**A novel biotechnological approach to protect crops from insect pests** 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.	**Honours** **Masters** **PhD**
Prof Jacqui Batley jacqueline.batley@uwa.edu.au	**Genomics of Plant pathogen interactions** 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 Leptosphaeria maculans, causal agent of Blackleg disease, and Brassica crops (canola, mustard, cabbage, cauliflower, broccoli, Brussels sprouts). The newly available genome sequences for Brassica spp. and L. maculans 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 Brassica species. This will involve phenotypic analysis of the disease in a variety of cultivars and species and association genetics to link to the phenotype	**Honours** **Masters** **PhD**
Karen Bell karen.bell@csiro.au karen.bell@uwa.edu.au **Bruce Webber** bruce.webber@csiro.au, bruce.webber@uwa.edu.au	**Detecting the floral fingerprint of biocultural dispersal** 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, andAncient 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.	**Honours** **Masters** **PhD**

Karen Bell karen.bell@csiro.au karen.bell@uwa.edu.au **Raphael Didham** raphael.didham@uwa.edu.au raphael.didham@csiro.au **Bruce Webber** bruce.webber@csiro.au bruce.webber@uwa.edu.au	**Using DNA metabarcoding to detect plant-pollinator interactions.** 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.	**Masters** **PhD**
Karen Bell karen.bell@csiro.au karen.bell@uwa.edu.au **Bruce Webber** bruce.webber@csiro.au, bruce.webber@uwa.edu.au **Martin Nunez** martin.nunez@csiro.au nunezm@gmail.com	**Tracing the introduction history of invasive plants.** The movement of plant species from one place to another is a significant anthropogenic impactThe 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 speciesthe 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.	**Honours** **Masters** **PhD**
Dr Heather Bray heather.bray@uwa.edu.au	**Media framing of scientific issues** 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 **how** 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.	**Honours** **Masters** **PhD**
Dr Heather Bray heather.bray@uwa.edu.au	**Employment outcomes for science communication students** 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.	**Honours** **Masters** **PhD**
Dr Bruno Buzatto, bruno.buzatto@uwa.edu.au **A/Prof Joseph Tomkins** joseph.tomkins@uwa.edu.au	**Male dimorphism and sexual conflict** 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 *Rhizoglyphus echinopus* , 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.	**Honours**

Dr Bruno Buzatto, bruno.buzatto@uwa.edu.au **A/Prof Joseph Tomkins** joseph.tomkins@uwa.edu.au	**Selection for larger weapons and fight performance** 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 *Rhizoglyphus echinopus* , 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 bewteen mites under the microscope and measuring their legs with image software.	**Honours** **Masters**
Dr Belinda Cannell belinda.cannell@uwa.edu.au **Dr Renae Hovey** renae.hovey@uwa.edu.au	**Population characteristics of Little Penguins in King George Sound, Albany** 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 trends 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. There are other colonies on offshore islands in SW WA, close to a major shipping port in King George Sound . However, there is very limited information 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.	**Honours** **Masters**
Dr Belinda Cannell belinda.cannell@uwa.edu.au **Dr Harriet Paterson** harriet.paterson@uwa.edu.au	**Does Chasmanthe, a bulbous plant, inhibit the habitat utilised by Little Penguins on Mistaken Island?** Little Penguins inhabit Mistaken Island, a DBCA -managed nature reserve, near Albany in SW WA, however there is limited data related to their ecology on the island. A study undertaken in 2020 identified many of the natural burrows utilised by the penguins. However it was noted that although *Chasmanthe* , a vigorous bulb from South Africa, was patchily distributed on the island, the density and height of it changed throughout the year, making it extremely difficult to walk through. Given that weeds such as Marram grass have been shown to inhibit penguins from being able to access, and dig burrows, in previously inhabited areas, it is thought that the *Chasmanthe* may have a similar impact on Mistaken Island. This project will investigate the density of *Chasmanthe* associated with penguin nesting habitat and document its change throughout the year. These data will support recommendations for the management of this weed.	**Masters**
Dr Renee Catullo renee.catullo@uwa.edu.au	**Conservation genetics of bushfire affected frogs/vertebrates** The 2019-2020 bushfires had a substantial impact on frog species endemic to the eastern Australian rainforests. Many of these species were threatened before the fires, and likely need further conservation actions. This computational genetics project will use genomic data to assess how the fires may affect genetic diversity in threatened frog species. Where needed, recommendations on translocations and establishing genetically healthy captive breeding populations will be provided. Projects focussed on developing methods to prioritise conservation efforts across many species would be suitable to a PhD.	**Honours** **Masters** **PhD**

Dr Cecile Dang cecile.dang@dpird.wa.gov.au **Prof Jacqui Batley** Jacqueline.batley@uwa.edu.au	**Investigation of microorganisms associated with health issues in pearl oysters Pinctada maxima from northern Australia** 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 (Pinctada maxima) farming industry in Western Australian has been hampered by health and productivity issues with no identified cause(s). 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. .	**Honours** **Masters**
Dr Cecile Dang cecile.dang@dpird.wa.gov.au **Prof Jacqui Batley** Jacqueline.batley@uwa.edu.au	**Pathogenicity of Vibrio spp. in pearl oysters Pinctada maxima from northern Australia** 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 (Pinctada maxima) farming industry in Western Australian has been hampered by health and productivity issues with no identified cause(s). Bacteria belonging to Vibrio alginolyticus 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 Vibrio alginolyticus 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. .	**Honours** **Masters**
Harriet Davies harriet.davies@uwa.edu.au **Dr Tim Langlois** tim.langlois@uwa.edu.au	**Developing Sea Country management protocols through combining traditional ecological knowledge of Indigenous Australians and Western Science.** 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.	**Honours** **Masters** **PhD**
Raphael Didham raphael.didham@csiro.au, raphael.didham@uwa.edu.au **Martin Nunez** martin.nunez@csiro.au nunezm@gmail.com **Bruce Webber** bruce.webber@csiro.au bruce.webber@uwa.edu.au	**How do plant-insect interactions differ between native and introduced ranges?** 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.	**Masters** **PhD**

Prof Michael Douglas michael.douglas@uwa.edu.au **Dr Leah Beesley** leah.beesley@uwa.edu.au **Ms Jen Middleton** jen.middleton@research.uwa.edu.au	**Leaf litter breakdown in a tropical northern river and/or a southern river** Forested streams derive much of their energy from the breakdown of terrestrial leaves that fall or are washed in. Leaves are colonised by bacteria and fungi and are then eaten by macroinvertebrates (i.e., shredders). In Australia, the breakdown of native leaves (i.e. eucalypts) is typically slow because of their tough waxy coating, low nutrient content, and their propensity to leach noxious compounds (e.g. polyphenols). Leaf breakdown may be faster in northern Australia because there are many deciduous and brevi-deciduous native plants which have softer more palatable leaves. Relatively few studies have examined leaf breakdown in western Australia. This study will describe the nutrient profile and breakdown of a range of native and non-native plant species in single and mixed-leaf packs. Fluorescent in-situ hybridisation will be used to characterise bacterial and fungal communities, and stable isotopic analysis will be used to investigate the incorporation of leaf carbon into the aquatic food web. The study will be conducted in Litchfield National Park, Northern Territory and possibly also in a southern River. The project is suitable for a student who is available for field work during the northern dry season (June-Sep.).	**Honours** **Masters** **PhD**
Prof Michael Douglas michael.douglas@uwa.edu.au **Dr Leah Beesley** leah.beesley@uwa.edu.au **Dr Caroline Canham** caroline.canham@uwa.edu.au	**Does riparian shading increase invertebrate cyst survival in floodplain wetlands? A study on the Fitzroy River, Kimberley** Floodplain habitats are often important nursery habitats for riverine fish, because they contain few fish predators and support a high abundance of suitable food. Microcrustaceans are important food for fish larvae and they can survive dry periods on floodplains by creating dormant cysts that sit in the soil. Floodplain trees that fringe floodplain creeks and wetlands provide shade to the soil and can promote the survival of microcrustacean cysts. Trees and the organic matter they deposit (leaves, bark) may also create shade and promote water retention providing an improved microclimate that may assist cysts. This study investigates the factors that shape the invertebrate cyst seed bank of the floodplain of the lower Fitzroy River. The study is specifically interested in whether vegetation promotes seed bank diversity by creating a better microclimate (temperature, shading) or whether the seed bank is linked to low lying areas on the floodplain, especially those close to refuge pools?	**Honours** **Masters**
Prof Michael Douglas michael.douglas@uwa.edu.au **Dr Leah Beesley** leah.beesley@uwa.edu.au **Ms Jen Middleton** jen.middleton@research.edu.au	**How is urbanisation altering the in-stream food web?** Urbanisation impacts streams in many ways. Scouring flows erode banks and wash away instream habitat including leaves. Increased light, elevated water temperature and nutrients promote algal growth. These changes can shift the stream food web from a leaf-litter driven system to one dominated by algae.The extent to which the system is able to process this food will be determined by the types of intertebrates present and the extent to which they are able to switch food resources. If animals are not able to consume the algae it can build up and becaome a nuisance. This study will work across a gradient of urbanisation and use stable isotopes as tracers to investigate the source of energy (leaf ltter, algae) supporting the food web. It will also use articificial substrates to quantify benthic algal growth and the ability of the invertebrate community to graze it. This knowledge will reveal the resilience of the stream invertebrate community to urbanisation and will identify species playing critical functional roles.	**Honours** **Masters** **PhD**
Prof Samantha Setterfield samantha.setterfield@uwa.edu.au **Dr Caroline Canham** caroline.canham@uwa.edu.au **Dr Leah Beesley** leah.beesley@uwa.edu.au	**Investigating the thermal benefits of riparian vegetation along Perth's urban waterways** Riparian vegetation is the term used to describe the plants that fringe streams and rivers. This vegetation plays many important ecological roles. One important role is shading the waterway and the adjacent land. In Perth, little is known about which trees and shrubs provide the best shading. We also know little about the density of planting needed to keep soil and water cool. This study will use field data collection to investigate the link between plant attributes (leaf area index, canopy cover, canopy height etc) and the thermal conditions of riparian soils and stream water. The findings will assist local government and landcare groups to design vegetation guidelines. This project is suitable for a student with a mid-year start that is able to conduct field work over the perth summer.	**Honours** **Masters**

Prof Dave Edwards dave.edwards@uwa.edu.au **Dr Elizabeth Sinclair** elizabeth.sinclair@uwa.edu.au **Dr Philipp Bayer** philipp.bayer@uwa.edu.au	**Comparative Genomics of Seagrass** 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.	**Honours** **Masters** **PhD**
Prof Dave Edwards Dave.Edwards@uwa.edu.au	**Applied bioinformatics** 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 recieve in training in the use of high performance computing in biology. Please contact Dave Edwards to discuss specific opportunities.	**Honours** **Masters** **PhD**
Prof Jon Evans, jonathan.evans@uwa.edu.au	**Ejaculate-mediated paternal effects as sources of non-genetic inheritance in guppies** 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 simulated predation risk experienced by adult males. 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.	**Honours**
Prof Jon Evans, jonathan.evans@uwa.edu.au	**Can environmental effects on sperm distort patterns of genetic variation in offspring fitness?** 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 M. galloprovincialis. By incorporating an experimental approach (where sperm are exposed to different environmental treatments) within a quantitative genetic breeding design (North Carolina II), 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 additive 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.	**Honours**
Prof Jon Evans, jonathan.evans@uwa.edu.au	**Can ocean pH influence gamete signalling mechanism in broadcast spawning marine invertebrates?** 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 M. galloprovincialis 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.	**Honours**

Assoc/Prof Patrick Finnegan patrick.finnegan@uwa.edu.au **E/Prof Hans Lambers** hans.lambers@uwa.edu.au	**Nutrient acquisition in Hakea prostrata (Proteaceae)** The Proteaceae (banksia, grevillea, etc.) are incredibly well adapted to the nutrient poor soils of Western Australia. Our model plant is Hakea prostrata (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 *Hakea prostrata* 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 *H. prostrata*. Unlike other plants, *H. prostrata* 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 *Hakea prostrata* genome sequence and RNAseq data, supplemented with your own quantitative PCR results.	**Honours** **Masters** **PhD**
Assoc/Prof Patrick Finnegan patrick.finnegan@uwa.edu.au	**Leaf functional traits in Proteaceae from southern China** The Proteaceae (banksia, grevillea, etc.) are considered to be a southern hemisphere plant family. Yet, two genera, *Helicia* and *Heliciopsis,* are found in Asia. In fact, *Helicia* 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.	**Honours** **Masters**
E/Prof Hans Lambers hans.lambers@uwa.edu.au **Assoc/Prof Patrick Finnegan** patrick.finnegan@uwa.edu.au **Dr Kosala Ranathunge** kosala.ranathunge@uwa.edu.au	**Why do Fabaceae, Myrtaceae and Proteaceae co-dominate on the most nutrient impoverished soils on earth?** 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 familes - 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 familes to live in nutrient poor environments.	**Honours** **Masters** **PhD**
Matthew Fraser matthew.fraser@uwa.edu.au, **Belinda Martin** belinda.martin@uwa.edu.au	**Saving our seagrass meadows with cutting-edge technology in environmental genomics.** Coastal ecosystems in Western Australia are facing a time of unprecedented pressures from a combination of population growth and climate change. This project will deliver impactful and innovative research in the field of environmental genomics that will increase the resolution and scale of the understanding of the processes and environmental drivers of habitat change across WA coastal systems. This project will involve sampling across several sites along the WA coastline, with a specific emphasis on Gathaagudu (Shark Bay), a World Heritage Site with important Traditional Owner, fisheries, and biodiversity significance that is under marked pressure from climate change.	**Masters** **PhD**

Pauline Grierson Pauline.Grierson@uwa.edu.au, **Svenja Tulipani (DWER)** **Greg Skrzypek** Grzegorz.Skrzypek@uwa.edu.au **Brad Degens (DWER)**	**Managing excess nutrients in aquatic ecosystems - understanding interactions between dissolved organic matter and phosphorus-binding clays.** 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.	**Honours** **Masters**
Dr Cyril C. Grueter cyril.grueter@uwa.edu.au **Prof Leigh Simmons** leigh.simmons@uwa.edu.au	**Sexual selection in action: risk taking in humans** 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.	**Honours**
Dr Patrick Hayes patrick.hayes@uwa.edu.au	**Plants are never at rest - switching from photosynthesis during the day to respiration at night** The daily switching from photosynthesis during the day to respiration at night changes many cellular processes and consequently changes how nutrients are invested within leaves over a single day. A greater control over how resources are invested may improve whole-plant efficiency and if this can be applied to crop species then it can reduce fertiliser demand in agriculture. This project will focus on the essential plant nutrient phosphorus, as it is intrinsically involved with both photosynthesis and respiration and is a major component of fertilisers. We will investigate how the concentration of different forms phosphorus change within leaves over a 24-hour period and will compare this between slow-growing but efficient native species and faster-growing, less efficient species, both native species and crops. This project will involve both field and glasshouse work.	**Honours**
Assoc. Prof. Jan Hemmi jan.hemmi@uwa.edu.au	**Heart rate monitoring of aquatic invertebrates** 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).	**Honours** **Masters** **PhD**
Assoc. Prof Jan Hemmi jan.hemmi@uwa.edu.au **Katarina Doughty** katarina.doughty@research.uwa.edu.au **Isobel Sewell** isobel.sewell@research.uwa.edu.au	**Finding alternative food sources for aquaculture** 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 (*Hermetia illucens*; 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.	**Honours** **Masters**

Assoc. Prof. Jan Hemmi jan.hemmi@uwa.edu.au	**Comparative colour vision and spatial vision in ants** 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).	**Honours** **Masters** **PhD**
Assoc. Prof. Jan Hemmi jan.hemmi@uwa.edu.au	**How fiddler crabs see the world** 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^2 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.	**Honours** **Masters** **PhD**
Assoc. Prof. Jan Hemmi jan.hemmi@uwa.edu.au **Dr Zahra Bagheri** zahra.bagheri@uwa.edu.au	**The role of polarisation in navigation** 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. 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.	**Honours** **Masters**
Assoc. Prof. Jan Hemmi jan.hemmi@uwa.edu.au	**Escape responses in fiddler crabs** 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.	**Honours** **Masters** **PhD**
Assoc. Prof. Jan Hemmi jan.hemmi@uwa.edu.au **Dr Zahra Bagheri** zahra.bagheri@uwa.edu.au **Anna-Lee Jessop** anna-lee.jessop@uwa.edu.au	**Comparative eye anatomy** 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 basesused 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.	**Honours** **Masters** **PhD**

Assoc. Prof. Jan Hemmi jan.hemmi@uwa.edu.au **Dr Zahra Bagheri** zahra.bagheri@uwa.edu.au	**Sampling visual world** 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.	**Honours** **Masters** **PhD**
Dr Zahra Bagheri zahra.bagheri@uwa.edu.au **Assoc. Prof. Jan Hemmi** jan.hemmi@uwa.edu.au	**Selective attention in the context of escape** Risk assessment and decision-making is an essential process for animal survival. In natural environments, animals are constantly exposed to several threating 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.	**Honours** **Masters**
Assoc. Prof. Jan Hemmi jan.hemmi@uwa.edu.au **Dr Tim Langlois** tim.langlois@uwa.edu.au **Callum Donohue** callum.donohue@uwa.edu.au	**Taking the pulse of crustaceans – monitoring heart rate in response to environmental changes** 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).	**Honours** **Masters**
Assoc. Prof. Jan Hemmi jan.hemmi@uwa.edu.au **Zac Sheehan** zachary.sheehan@research.uwa.edu.au	**The function of the lobula plate in crustaceans** 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.	**Honours** **Masters**
Dr Renae Hovey renae.hovey@uwa.edu.au **Dr Harriet Paterson** harriet.paterson@uwa.edu.au	**Distribution of plastics in southern esturine ecosystems, Western Australia** 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 esturine ecosystems which sit at the interface between land and sea.	**Honours** **Masters** **PhD**

Prof Simon Jarman simon.jarman@uwa.edu.au	**Comparing and modeling patterns of biodiversity** 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.	**Honours** **Masters**
Prof Simon Jarman simon.jarman@uwa.edu.au **Dr Andrew Bissett** **andrew**.bissett@csiro.au	**How many species of Fungi are there in australian soils?** 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 occurence 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.	**Honours** **Masters**
Dr Jennifer Kelley jennifer.kelley@uwa.edu.au **Assoc. Prof Jan Hemmi** jan.hemmi@uwa.edu.au	**Social behaviour and predation risk in freshwater fishes** 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 (*Melanotaenia australia*), 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 interations and grouping dynamics in animals.	**Honours** **Masters**
Dr Jennifer Kelley jennifer.kelley@uwa.edu.au **Assoc. Prof Jan Hemmi** jan.hemmi@uwa.edu.au	**Perception of colour patterns in freshwater fishes** 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 (*Melanotaenia australis*) 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.	**Masters** **PhD**
Dr Jennifer Kelley **jennifer.kelley@uwa.edu.au**	**3D camouflage in artificial moths.** 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 involved fieldwork in local woodlands and will involve photography and image editing techniques.	**Honours** **Masters** **PhD**

Prof Gary Kendrick gary.kendrick@uwa.edu.au **Dr Elizabeth Sinclair** elizabeth.sinclair@uwa.edu.au	**Saving seagrass from climate change.** This project will address fitness in Posidonia seagrass meadows and how it may be improved through genetic connectivity. This research will target range edge seagrass meadows, with a focus on the World Heritage site Shark Bay. There are several opportunities to develop projects around genomic diversity, genetic regulation of flowering, and testing outcrossing in range edge populations.	**Masters** **PhD**
Jason Kennington (jason.kennington@uwa.edu.au) **Joseph Tomkins (**joseph.tomkins@uwa.edu.au)	We have a number of project ideas relating to the evolutionary genetics of sexual selection. Primarily we are interested in separating the effects of different bouts of sexual selection and identifying their effects on fitness and the genome. The questions are directly relevant to Evolutionary genetics, sexual selection but also conservation and the management of species in captivity.We have a recently funded ARC discovery project and we are seeking students to help realise the objectives of theis research. The main task is understanding the difference between the outcomes of intrasexual and intersexual selection. This will involve mating trials, quantification of sexual selection and artificial selection for 'studs' and 'duds' (e.g. Dugand et al 2018,2019). These projects are focussed on Drosophila melanogaster. Topics: **1) Separating male competition and female choice. 2) Separating the effects of pre and postcopulatory sexual selection. 3) Testing the resurgence of Lamarck's hypothesis for the inheritance of environmentally induced variation.** **4) Manipulating the costs of male display.**	**Honours** **Masters**
Prof Hans Lambers hans.lambers@uwa.edu.au **Asst/Prof Matthias Leopold** matthias.leopold@uwa.edu.au **Dr Kosala Ranathunge** kosala.ranathunge@uwa.edu.au **Dr Hongtao Zhong** hongtao.zhong@uwa.edu.au	**Phytogeography of Declared Rare Flora species at Great Brixton Street Wetland or Alison Baird Reserve?** 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.	**Honours** **Masters**
E/Prof Hans Lambers hans.lambers@uwa.edu.au **Assoc/Prof Patrick Finnegan** patrick.finnegan@uwa.edu.au **Dr Kosala Ranathunge** kosala.ranathunge@uwa.edu.au	Why do Fabaceae, Myrtaceae and Proteaceae co-dominate on the most nutrient impoverished soils on earth? 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 familes - 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 familes to live in nutrient poor environments.	Honours Masters

Dr Tim Langlois, tim.langlois@uwa.edu.au **Shaun Wilson** shaun.wilson@dbca.wa.gov.au **Thomas Holmes** thomas.holmes@dbca.wa.gov.au	**What drives change in size spectra of fish assemblages?** 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.	**Honours** **Masters** **PhD**
Dr Tim Langlois, tim.langlois@uwa.edu.au **Dr. Matt Navarro** matthew.navarro@uwa.edu.au **Dr. Jacquomo Monk** jacquomo.monk@utas.edu.au	**Monitoring highly targeted mesophotic fish populations: optimising stereo-video monitoring of large offshore no-take marine reserves** 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 *Polyprion oxygeneios*) 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.	**Honours** **Masters** **PhD**
Dr Craig Lawrence craig.lawrence@dpird.wa.gov.au **Dr Justin Blythe** justin.blhythe@watercorporation.com.au **Assoc Prof Julian Partridge** julian.partridge@uwa.edu.au **Prof Phil Vercoe** philip.vercoe@uwa.edu.au	**Using fish as biosentinels to protect our drinking water supply** 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.	**Honours**
Prof Jessica Meeuwig jessica.meeuwig@uwa.edu.au	**Changes in scale of coral bleaching in the British Indian Ocean Territory.** 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.	**Honours**
Professor Jessica Meeuwig jessica.meeuwig@uwa.edu.au	**Detecting coral bleaching from baited remote underwater visual imagery** Assessment of coral bleaching largely relies on either aerial surveys of *in situ* 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.	**Masters**

Professor Jessica Meeuwig jessica.meeuwig@uwa.edu.au	**Environmental DNA in pelagic environments** This project would develop a protocol for obtaining eDNA samples in Western Australiafor pelagic species, that would include contributing to a global library of bar codes for pelagic species.	**Masters** **PhD**
Prof Jessica Meeuwig jessica.meeuwig@uwa.edu.au **Prof Christine Erbe** (Curtin)	**Cross-shelf patterns in fish biodiversity at Bremer Basin.** 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 an d (2) interpreting this in terms of regional diversity.	**Honours**
Dr Nicola Mitchell nicola.mitchell@uwa.edu.au **Dr Gerald Kuchling** gerald.kuchling@dbca.wa.gov.au	Embryos across many vertebrate taxa appear to optimise the timing of hatching in response to environmental cues that are linked to favourable conditions. In western swamp turtles *(Pseudemydura umbrina)* delayed hatching appears to be a critical adaptation, as hatching too early would likely mean hatchlings have no available food sources. Similarly, synchronous hatching may be present in the species, which may confer adaptive benefits around predator evasion. The cues that trigger hatching in *P. umbrina,* or what coordinates this behaviour, are unclear. Recent studies shows that turtles exhibit surprisingly complex social behaviour, some species have been found to vocalise within the egg, and embryo-embryo communication has been hypothesised as a potential mechanism influencing synchronous hatching and emergence. Elucidating the environmental and behavioural triggers for emergence, and how triggers vary across translocation sites is an important research consideration. Your role will be to find and radio-track gravid female turtles over the duration of the nesting season to locate wild nests. Environmental conditions in the nest will be measured, and later microphones will be inserted to investigate embryo communication. It is expected that you will use data collected in this project to further develop an existing model of the nest microclimate by incorporating an estimate of hatching and emergence success, which will allow appraisal of optimal translocation sites for embryos and hatchlings. This is a collaborative project with the Department of Biodiversity, Conservation and Attractions (Swan District and The Perth Zoo) and will suit a student with an aptitude for self-directed fieldwork. Applicants should ideally have experience working with reptiles, previous experience with radio-tracking over land and in freshwater, and strong anaytical skills.	**Masters**
Dr Matt Navarro, matthew.navarro@uwa.edu.au **Dr Tim Langlois** tim.langlois@uwa.edu.au **Dr Dave Fairclough** David.Fairclough@fish.wa.gov.au	**Designing recreaitonal fishing policies using representative fisher preferences** 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.	**Honours** **Masters**
Dr Matt Navarro, matthew.navarro@uwa.edu.au **Dr Tim Langlois** tim.langlois@uwa.edu.au **Dr. Jacquomo Monk** jacquomo.monk@utas.edu.au	**Spatial usage of the Australian Marine Parks network** 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.	**Honours** **Masters**

Dr Harriet Paterson harriet.paterson@uwa.edu.au **Dr Renae Hovey** renae.hovey@uwa.edu.au	**Plastics in the regurgitated content from sea birds from Lancelin, Western Australia** 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.	**Honours** **Masters**
Dr Giovanni Polverino giovanni.polverino@uwa.edu.au **Prof Jon Evans** jonathan.evans@uwa.edu.au	**Fitness consequences of personality in guppies and mosquitofish** 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).	**Honours**
Dr Giovanni Polverino giovanni.polverino@uwa.edu.au **Prof Jon Evans** jonathan.evans@uwa.edu.au	**Links between plasticity traits in guppies and mosquitofish** 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.	**Honours**
Giovanni Polverino (giovanni.polverino@uwa.edu.au) **Joseph Tomkins (**joseph.tomkins@uwa.edu.au)	**The development of personality**. The Rottnest Island brine shrimp *Artemia parthenogenetica* , is, as its name suggests, parthenogenetic. How cool is that! Instantly available genetic lineages for studying reaction norms, plasticity and responses to the environment! We have established a laboratory culture of these brine shrimps and are looking for a student to start assaying lifetime variation in their response to environmental cues such as fear.	**Honours** **Masters**
Pieter Poot pieter.poot@uwa.edu.au **Erik Veneklaas** erik.veneklaas@uwa.edu.au **Sally Thompson** sally.thompson@uwa.edu.au	**Revegetation of solar farms** Solar farms are increasingly being established across SW Australia to generate renewable energy and they are an important component into transitioning our economy into one with net zero carbon emissions by 2050 or earlier. For obvious reasons, solar farms cannot have tall emerging vegetation amongst the array of solar panels, and thus solar farms need active management of vegetation, either through regular mowing or herbicide spraying. However, keeping vegetation to a minimum or having bare soil under solar panels could lead to wind or water erosion issues. Both vegetation and erosion control activities add considerable costs to the solar farm operation. Establishing low prostrate native vegetation under solar panels could potentially greatly reduce these ongoing site maintenance costs, while at the same time increasing local biodiversity values. Additionally, the likely reduction in ambient temperatures as a consequence of establishing a native vegetation cover could improve solar panel energy conversion. This project will investigate the scope for native vegetation establishment under solar farms in SW Australia, both through a literature study and through experimental analysis of the establishment phase of prostrate vegetation on a local solar farm site. Through collaboration with the Surface and Ecohydrology research group at UWA, there will also be an opportunity to investigate and document changes in microclimate, water flows and erosion as a consequence of solar panel placement. The project will be in collaboration with local industry partners (solar energy companies, mining companies & nurseries), and is likely to lead to future grant applications to address these issues at a larger scale.	**Honours** **Masters (with the potential for a follow up PHD)**

Dr Cristina E Ramalho cristina.ramalho@uwa.edu.au	**Biodiversity and human-nature connection considerations in urban forest management** 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.	**Honours** **Masters** **PhD**
Dr Cristina E Ramalho cristina.ramalho@uwa.edu.au	**Ecological benefits and functional gaps in native plant palettes commonly used in urban greening** 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	**Honours** **Masters** **PhD**
Dr Kosala Ranathunge kosala.ranathunge@uwa.edu.au **E/Prof Hans Lambers** hans.lambers@uwa.edu.au	**Understanding the traits of cluster- and non-cluster-roots in Proteaceae plants** 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.	Honours Masters PhD

Dr Kosala Ranathunge kosala.ranathunge@uwa.edu.au	**Silicon and the plant cell wall matrix** 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+ under salinity stress. Since Na+ 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+ transport into the stele. This project will investigate how Si can deminish Na+ uptake in roots of rice using anatomical, biochemical, physiological and molecular biological techniques.	Honours Masters PhD
Dr Michael Renton michael.renton@uwa.edu.au **Dr Francois Teste** francois.teste@uwa.edu.au	**Evolution and ecology of plant-fungal interactions during invasion** 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 managment 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.	**Honours** **Masters**
Dr Michael Renton michael.renton@uwa.edu.au **Dr Pieter Poot** pieter.poot@uwa.edu.au	**Evolution of rooting strategies** 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.	**Honours** **Masters**
Dr Michael Renton michael.renton@uwa.edu.au	**Ecological and Evolutionary Modelling for Agriculture and Conservation** 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: - 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? - How can we maintain global food security by stopping weeds and pests evolving resistance to pesticides? - What is the best way to search for and manage invasive organisms that threaten our agricultural industries and natural resources? - How do interactions among the individual organisms in ecological communities affect the diversity, stability and resilience of these communities? 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.	**Masters** **PhD**

Assoc Prof Amanda Ridley amanda.ridley@uwa.edu.au	**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 casues 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 behavour. The study sites are based within urban Perth. Students will need access to reliable transport, and to have a full driver's license.	**Honours** **Masters** **PhD**
Dr Alison Ritchie alison.ritchie@uwa.edu.au **Dr Todd Erickson** todd.erickson@dbca.wa.gov.au	**Developing technologies to overcome barriers to seed recruitment and seedling establishment in restoration** This project aims to develop and implement innovative seed enhancement technologies to overcome native plant recruitment barriers. Despite technological advances in the agricultural industry to successfully establish plants, there is currently limited capacity to deliver this technology to restore biodiverse natural ecosystems. With ongoing degradation and significant biodiversity loss occurring in large parts of southern Australia, intervention is needed to reinstate critical ecosystems. In order to so, we need to overcome the diverse array of abiotic and biotic factors that currently limit restoration success. The student will focus on (1) overcoming the barriers to restoration, (2) the development of seed enhancement technologies and (3) test their scalability in the field.	**Honours** **Masters** **PhD**
Dr Abbie Rogers, Dr Belinda Cannell, Prof Michael Burton belinda.cannell@uwa.edu.au	**How big is the value of a little penguin?** 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.	**Honours** **Masters**
Dr Ana M M Sequeira (UWA) ana.sequeira@uwa.edu.au **Dr Matthew Fraser (UWA)** matthew.fraser@uwa.edu.au **Prof Gary Kendrick (UWA)** gary.kendrick@uwa.edu.au	**Ecological links between coastal habitats and marine megafauna conservation** 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, Amphibolis antarctica, 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.	**PhD** **Honours** **Masters**

Dr Ana M M Sequeira (UWA) ana.sequeira@uwa.edu.au **Dr Matthew Fraser (UWA)** matthew.fraser@uwa.edu.au **Dr Hector Lozano-Montes (CSIRO)** hector.lozano-montes@csiro.au **Dr Ben Radford (AIMS)** B.Radford@aims.gov.au **Prof Gary Kendrick (UWA)** gary.kendrick@uwa.edu.au	**Understanding the iconic World Heritage Shark Bay using an ecosystem modelling framework** 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. 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.	**PhD** **Honours** **Masters**
A/Prof Samantha Setterfield samantha.setterfield@uwa.edu.au Dr Caroline Canham caroline.canham@uwa.edu.au	**The effect of duration of inundation on riparian seedlings** Understanding the dynamics of riparian seedbanks is a critical component of informing sustainable water management decisions. There are a number of potential studies to investigate this, including a glasshouse study to investigate the effect of duration of inundation on the emergence of tropical riparian seedlings and a study of seedbank collected from the Fitzroy River.	**Honours** **Masters**
A/Prof Samantha Setterfield samantha.setterfield@uwa.edu.au Dr Caroline Canham caroline.canham@uwa.edu.au	Using land surface temperature to map floodplain wetlands of the Fitzroy River Floodplain wetlands are vital refugia for biota during the dry season in the wet-dry environment of the Fitzroy River in the Kimberley region of Western Australia. Remote sensing of land surface temperature can be used to map these habitats and historical datasets may be examined to determine wetland extent and condition under years of different flow. This project will involve significant analysis of datasets collected from remote sensing.	**Honours** **Masters**
A/Prof Samantha Setterfield samantha.setterfield@uwa.edu.au Dr Caroline Canham caroline.canham@uwa.edu.au	**Water requirements of riparian vegetation** The sustainable management of water resources requires an understanding of the relationship between surface and subsurface water and the plants dependent on it. We do applied research, collaborating with water managers, to work towards understanding the water requirements of riparian and groundwater dependent vegetation in northern and south western Australia. Potential projects may be field or glasshouse based and may include measurements of LAI, plant ecophysiology, seed bank studies or germination trials for native plants.	**Honours** **Masters**
Professor Leigh Simmons leigh.simmons@uwa.edu.au	**Seminal fluid effects on female sexual receptivity** 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 (Teleogryllus oceanicus) 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.	**Honours** **Masters**

Professor Leigh Simmons leigh.simmons@uwa.edu.au	**Risk taking behaviour and residual reproductive value** 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 (Teleogryllus oceanicus) of the same age after manipulating their RRV by surgical removal of the ovaries.	**Honours Masters**
Professor Leigh Simmons leigh.simmons@uwa.edu.au	**Sexual selection and sperm competition** 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.	**Honours** **Masters** **PhD**
Professor Leigh Simmons leigh.simmons@uwa.edu.au	**The evolution of mating spurs in trapdoor spiders** 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.	**Honours** **Masters**
Professor Leigh Simmons leigh.simmons@uwa.edu.au **Dr Nikolai Tatarnic** nikolai.Tatarnic@museum.wa.gov.au	**Traumatic insemination in plant bugs** 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 Coridromius 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.	**Honours** **Masters** **PhD**
Professor Leigh Simmons leigh.simmons@uwa.edu.au **A/Professor Jan Hemmi** jan.hemmi@uwa.edu.au	**The costs of male weaponry: are males with enlarged weapons visually impaired** 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.	**Honours**

Prof Leigh Simmons leigh.simmons@uwa.edu.au **Dr Tim Langlois,** tim.langlois@uwa.edu.au **Dr Simon de Lestang** **s**imon.deLestang@fish.wa.gov.au **Dr Jason How** jason.how@fish.wa.gov.au	**Fertilization ecology and implications of sperm limitation in the western rock lobster** 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.	**Honours** **Masters**
Dr Greg Skrzypek grzegorz.skrzypek@uwa.edu.au **Dr Mat Vanderklif** mat.vanderklift@csiro.au	**Ecology of feral predators at Ningaloo:** 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.	**Masters**
Greg Skrzypek Grzegorz.Skrzypek@uwa.edu.au **Brad Degens (DWER)**	**Stable sulfur isotope composition as a tracer of nutrients runoff form agrosystems**. This research project is using a unique stable isotope tracer to estimate sufur 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.	**Honours** **Masters**
Dr Greg Skrzypek grzegorz.skrzypek@uwa.edu.au **Liz Barbour** liz.barbour@uwa.edu.au	**Identification of honey origin using stable isotope and ecological provenancing.** The bees are under pressing threats resulting from climate change, habitat loss/fragmentation, and the spread of diseases. Several radical regulations were implemented to protect honey marked and bees well-being, and therefore an urgent need to develop methods allowing identification of honey origin exists. This study will focus on testing links between the honey stable carbon and oxygen isotope signatures, geographic location, plant communities, and water sources on the landscape scale. The project will be conducted in collaboration with financial support from CRC for Honey Bee Products. Supervisors: Greg Skrzypek, Liz Barbour	**Honours** **Masters**
Ruchira Somaweera ruchira.somaweera@csiro.au **Bruce Webber** bruce.webber@csiro.au bruce.webber@uwa.edu.au	**Mitigating global change impacts on vertebrate conservation outcomes** 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.	**Honours Masters PhD**

Dr John Statton john.statton@uwa.edu.au **Prof. Gary Kendrick** garykendrick@uwa.edu.au	**Optimising sporophyte growth for commercialisation of the methane mitigating seaweed, *Asparagopsis taxiformis*** Seaweed is one of the most attractive emerging aquaculture industries Australia-wide. The Red Seaweed, Asparagopsis taxiformis, when fed to cattle in small quantities, can mitigate harmful methane emissions from the livestock industry by up to 98%. Asparagopsis could become the 'wheat crop' of Australia's oceans, and is on track to be grown and processed here in Australia. This project will focus on optimising cultivation techniques to produce high quality seed stock for Western Australian conditions. This project is aquaculture focussed and will use dose:response testing of environmental variables (light, nutrients) to optimise this life stage. This project will be based at the Watermans Bay Marine Research Facility (30 minutes north of UWA crawley campus), successful candidates need to be part-time located at this facility to undertake the research trials. Snorkelling, strongly lab-based project, desire to learn about aquaculture techniques and seaweed.	**Honours** **Masters**
Dr John Statton john.statton@uwa.edu.au **Prof. Gary Kendrick** garykendrick@uwa.edu.au	**Optimise sporophyte density of *Asparagopsis taxiformis* to enhance seeding onto cultivation string** Seaweed is one of the most attractive emerging aquaculture industries Australia-wide. The Red Seaweed, Asparagopsis taxiformis, when fed to cattle in small quantities, can mitigate harmful methane emissions from the livestock industry by up to 98%. Asparagopsis could become the 'wheat crop' of Australia's oceans, and is on track to be grown and processed here in Australia. This project will determine the density that optimises attachment, survivability and growth of sporophytes prior to transfer to grow-out trials. This project will be based at the Watermans Bay Marine Research Facility (30 minutes north of UWA crawley campus), successful candidates need to be part-time located at this facility to undertake the research trials. Snorkelling, strongly lab-based project, desire to learn about aquaculture techniques and seaweed.	**Honours** **Masters**
Dr John Statton john.statton@uwa.edu.au **Prof. Gary Kendrick** garykendrick@uwa.edu.au	**Enhance gametophyte fecundity of *Asparagopsis taxiformis* for aquaculture** Seaweed is one of the most attractive emerging aquaculture industries Australia-wide. The Red Seaweed, Asparagopsis taxiformis, when fed to cattle in small quantities, can mitigate harmful methane emissions from the livestock industry by up to 98%. Asparagopsis could become the 'wheat crop' of Australia's oceans, and is on track to be grown and processed here in Australia. This project aims to enhance fecundity of gametophytes by testing dose:response relationships of environmental conditions (nutrients x light x temperature). Enhanced fecundity of gametophytes is a necessary pathway to developing the commercialisation potential of this seaweed species. This project will be based at the Watermans Bay Marine Research Facility (30 minutes north of UWA crawley campus), successful candidates need to be part-time located at this facility to undertake the research trials. Snorkelling, strongly lab-based project, desire to learn about aquaculture techniques and seaweed.	**Honours** **Masters**
Joseph Tomkins (joseph.tomkins@uwa.edu.au) **Jason Kennington** (jason.kennington@uwa.edu.au) **Wladimir Fae** (wladimir.faeneto@research.uwa.edu.au)	**Experimental Evolution of Anisogamy** We have a number of experimental evolution lines of the single celled alga *Chlamydomonas reinhardtii* that have diverged in size and in their growth conditions. These evolved lines are of interest to us from an evolutionary perspective in terms of the evolution of anisogamy.	**Honours** **Masters**
Joseph Tomkins (joseph.tomkins@uwa.edu.au) **Jason Kennington** (jason.kennington@uwa.edu.au) **Wladimir Fae** (wladimir.faeneto@research.uwa.edu.au)	**Experimental Evolution of Algal biofuel** We have a number of experimental evolution lines of the single celled alga *Chlamydomonas reinhardtii* that have diverged in size and in their growth conditions. These evolved lines are of interest to us from the perspective of applying them to questions of algal production (e.g. biomass, pigments and lipids) in the lab and 'field' conditions.	**Honours** **Masters**

Assoc.Prof Erik Veneklaas erik.veneklaas@uwa.edu.au **Dr Paul Drake** paul.drake@uwa.edu.au	**Water and CO2 transport in relation to stomatal distribution** 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, CO2 and energy.	**Honours** **Masters**
Assoc. Prof Erik Veneklass erik.veneklaas@uwa.edu.au **Dr** **Paul Drake** paul.drake@uwa.edu.au	**How does vegetation affect the water balance on mine waste rock dumps?** 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.	**Honours Masters PhD**
Assoc. Prof Erik Veneklaas erik.veneklaas@uwa.edu.au **Dr** **Fiamma Riviera** fiamma.riviera@uwa.edu.au **Justin Valliere** justin.valliere@uwa.edu.au	**Ecophysiological research to support mine-site restoration** 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.	**Honours Masters**
Assoc. Prof Erik Veneklaas erik.veneklaas@uwa.edu.au **Dr** **Carlolyn Harding** carolyn.harding@dbca.wa.gov.au	**Salinity and drought tolerance of samphires in a Swan river saltmarsh** 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.	**Honours** **Masters**
Assoc. Prof Erik Veneklaas erik.veneklaas@uwa.edu.au	**Plant water relations** 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.	**Honours Masters PhD**

Prof Erik Veneklaas erik.veneklaas@uwa.edu.au **Dr** **Siegy Krauss** siegy.krauss@dbca.wa.gov.au **Dr** **David Merritt** david.merritt@dbca.wa.gov.au **Dr** **Michael Renton** michael.renton@uwa.edu.au **Dr** **Suzanne Prober** suzanne.prober@csiro.au **Dr** **Martin Breed** martin.breed@flinders.edu.au	**Optimising seed sourcing for effective ecological restoration** 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.	**Honours Masters PhD**
Bruce Webber bruce.webber@csiro.au, bruce.webber@uwa.edu.au **Martin Nunez** martin.nunez@csiro.au nunezm@gmail.com **Raphael Didham** raphael.didham@uwa.edu.au raphael.didham@csiro.au	**Identifying vulnerabilities to improve the management of threatening weeds.** Improvements in weed management can be achieved through a greater understanding of the population ecology of the species in question, as well as itsplant 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	**Masters PhD**
Bruce Webber bruce.webber@csiro.au bruce.webber@uwa.edu.au	**A taxonomic revision of *Ryparos* a (Achariaceae)** Ryparosa 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.	**PhD**
Thomas Wernberg thomas.wernberg@uwa.edu.au, wernberglab.org	**Developing a novel restoration tool for threatened kelp forests** 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 help 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. This project can be field based or laboratory based. There are also opportunities for this project to include social-ecological research and science communication, such as engaging with communities to evaluate and test this restoration tool.	**Honours Masters PhD**

Thomas Wernberg thomas.wernberg@uwa.edu.au, wernberglab.org	**Thresholds for kelp forest loss and turf expansion.** Pervasive habitat deterioration and destruction presents one of the biggest threats to species and global ecological function. There has been an accelerating loss 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.	**Honours** **Masters** **PhD**
Thomas Wernberg thomas.wernberg@uwa.edu.au, wernberglab.org	**Using strong genotypes to boost resistance or restore threatened kelp forests** 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.	**Honours** **Masters** **PhD**
Thomas Wernberg thomas.wernberg@uwa.edu.au **Karen Filbee-Dexter** karen.dexter@uwa.edu.au	**Export of blue carbon from kelp forests to deep marine sinks.** One approach to combat climate change is to increase carbon storages and sinks. Recent research suggests that large seaweed forests may sequester substantial amounts of carbon in the deep sea. Key unknowns remain about the fate of this carbon once it leaves the shallow reefs; especially how much is transported across the shelf and reaches deep marine sediments. This project will use an underwater camera system to track kelp detritus moving from shallow reefs (<20 m) to deeper areas (20 - 100 m) off Western Australia. Laboratory flume trials will be used to measure deposition and resuspension thresholds of different types of kelp detritus, which are essential to predict movement along the seafloor. This research should help assess the carbon storage potential of kelp forests. The project will involve work in the field and the lab. A background in field ecology and/or oceanography would be helpful but not essential.	**Honours** **Masters** **PhD**
Thomas Wernberg thomas.wernberg@uwa.edu.au **Karen Filbee-Dexter** karen.dexter@uwa.edu.au	**Tracking coral growth in temperate Western Australia**. Temperature is a significant driver controlling many biological processes, such as skeletal growth in scleractinian corals. This process can be altered by extreme climatic events (i.e. marine heatwaves, cold spells), which are happening ever more frequently and lasting longer. This project will measure the density banding in coral skeletons to assess changes in growth under current conditions and recent temperature extremes. The work will involve coral collection, and diving skills would be helpful to have (but not essential). This project will improve our understanding of how these corals might be expanding their ranges poleward in the temperate reefs as a consequence of anthropogenic climate change.	**Honours** **Masters**

Dr Dan White daniel.white@uwa.edu.au	**Conservation genetics and population modelling to secure wild populations of the Shark Bay mouse** 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. This project provides an opportunity to help inform management of populations of the Vulnerable (IUCN, EPBC Act) Shark Bay mouse (Pseudomys fieldi). 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 fo rpredicting extinction probabilities of remaining populations, as well as devisign translocation scenarios for successful establishment on DHI. 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.	
Professor Philip Withers philip.withers@uwa.edu.au **Dr. Christine Cooper** c.cooper@curtin.edu.au	**What controls insensible evaporative water of mammals and birds?** 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.	**Honours** **Masters**
Professor Philip Withers philip.withers@uwa.edu.au **Dr. Christine Cooper** c.cooper@curtin.edu.au	**Comparison of thermal imaging and spot-lighting as tools for nocturnal mammal surveys** 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.	**Honours** **Masters**
Prof Phillip Withers phillip.withers@uwa.edu.au **Dr** **Graham Thompson** graham.thompson@uwa.edu.au **Dr** **Christine Cooper** christine.cooper@uwa.edu.au	**Assessing the efficacy of camera traps for fauna surveys** 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 imporve 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 prgrams, 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.	**Honours** **Masters**

Prof Phillip Withers phillip.withers@uwa.edu.au **Dr Sean Thomlinson** sean.thomlinson@dbca.wa.gov.au **Dr Christine Cooper** christine.cooper@uwa.edu.au **Amanda Bourne** abourne.uct@gmail.com	**Validation of non-invasive measurement of energy and water turnover for birds** Stable isotopes (doubly-labelled water, 2H2O18) 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).	**Honours Masters**
Professor Dirk Zeller dirk.zeller@uwa.edu.au	**Fisheries in Indian Ocean Rim countries** 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 (www.seaaroundus-io.org), 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 (www.seaaroundus.org) and the interdisciplinary Global Fisheries Cluster (http://global-fc.oceans.ubc.ca/) at the University of British Columbia in Vancouver, Canada, and with FishBase (www.fishbase.org) and SeaLifeBase (www.sealifebase.org) 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.	**Honours Masters PhD**
Prof Dirk Zeller dirk.zeller@uwa.edu.au **Dr Gabriel Vianna** gabe.vianna@uwa.edu.au	**Using satellite-data from the Global Fishing Watch to infer likely catches by foreign fleets inside EEZs and on the High Seas in the India Ocean** Recent technological advances in remote monitoring technology are increasingly being used to assist broad-scale marine conservation and fisheries management objectives. These technologies are particularly useful for fisheries monitoring in low-income regions and on the High Seas, where the lack of resources for adequate monitoring and surveillance and the vast extents of ocean make it difficult to keep track of fishing activity. To address this issue, the Global Fishing Watch initiative has developed a fisheries monitoring tool that enable the estimate of fishing effort by registered commercial fishing vessels anywhere in the world. The proposed project will adopt a novel approach to expand the use of this tool by combining the Sea Around Us fisheries catch reconstructed data with the Global Fishing Watch fishing effort dataset to generate estimates of foreign fishing catches within EEZs of low-income countries and on the High Seas in the Indian Ocean region. Thus, despite potentially high uncertainty, this project will generate urgently needed estimates on foreign and distant-water fisheries, which are hard to monitor, to enable national and regional decision-makers to better manage fisheries. This research does not involve field-based data collection, as we emphasize the utility of pre-existing databases and data sets. Students are expected to have R programming skills, exercise use of their critical thinking skills, be self-driven and have curiosity about fisheries data science. Good and collegial communication, networking and collaborative skills are also required, as this project form part of the Sea Around Us' international collaboration with the Global Fishing Watch initiative.	**Honours Masters PhD**

Prof Dirk Zeller dirk.zeller@uwa.edu.au **Dr Gabriel Vianna** gabe.vianna@uwa.edu.au	**The largest freshwater fishery data challenge in Africa: Lake Victoria** Tanzania, Kenya and Uganda are the major stakeholders in the largest freshwater body in Africa, Lake Victoria, which has the biggest freshwater fishery in Africa. Much of the regional food security, domestic livelihoods and local economic benefits are derived from this freshwater fishery, yet it is heavily under-valued and under-represented in fisheries science and policy at the national and regional level, as it is largely dominated by marginalized small-scale fishers that do not feature adequately or accurately in national data used for decision making. As part of the international *Sea Around Us - Indian Ocean* research initiative (www.seaaroundus-io.org), the student will engage in a fisheries data science project to improve and update the globally available data on freshwater fisheries catches and fishing effort of Lake Victoria's freshwater fisheries. This research builds on a successful freshwater project in 2020 for Kenya, and may directly contribute to and participate in a regional capacity enhancement workshop and training initiative for the Lake Victoria scientific community being held in late 2021. These projects generally do not involve field-based data collection, as we emphasize the utility of pre-existing data sets and close international collaborations with in-country experts for enhancement through data gap assessments and large-scale meta-analyses. Such collaborations require sensitivity and diplomatic interpersonal skills due to the sensitivity associated with the colonial history in East Africa. An open, curious and keen mind, critical thinking skills, self-drive and a curiosity about fisheries data science is crucial. While not crucial, if you also have some R programming skills …. all the better.	**Honours Masters PhD**