UNIVERSITY OF CANBERRA

INSTITUTE FOR APPLIED ECOLOGY

- CONSERVATION
- ECOTOXICOLOGY
- ENVIRONMENTAL CHEMISTRY
- ENVIRONMENTAL DNA
- FRESHWATER SCIENCE
- GENETICS AND GENOMICS
- INVASION BIOLOGY
- NATURAL RESOURCE MANAGEMENT

PHD OPPORTUNITIES IN 2019

INSTITUTE FOR APPIED ECOLOGY

Contents

Photo by Dr Sue Nichols

ABOUT THE INSTITUTE

The Institute for Applied Ecology (IAE) has a reputation for world class research with an applied focus.

We engage with on-ground managers and policy makers to enhance decision-making for natural resource management.

Our expertise in freshwater ecology, conservation biology, genetics, environmental chemistry and landscape modelling combine to address environmental problems.

We engage with external stakeholders to provide innovative and practical solutions.

The IAE:

- Carries out quality research both independently and in partnership
- Provides technical advice to private and public-sector partners on environmental issues
- Brokers the creation of interdisciplinary teams to address environmental research needs
- Develops the next generation of environmental scientists through Honours, PhD and early career training and mentoring programs

Find out more about our research highlights in 2017.

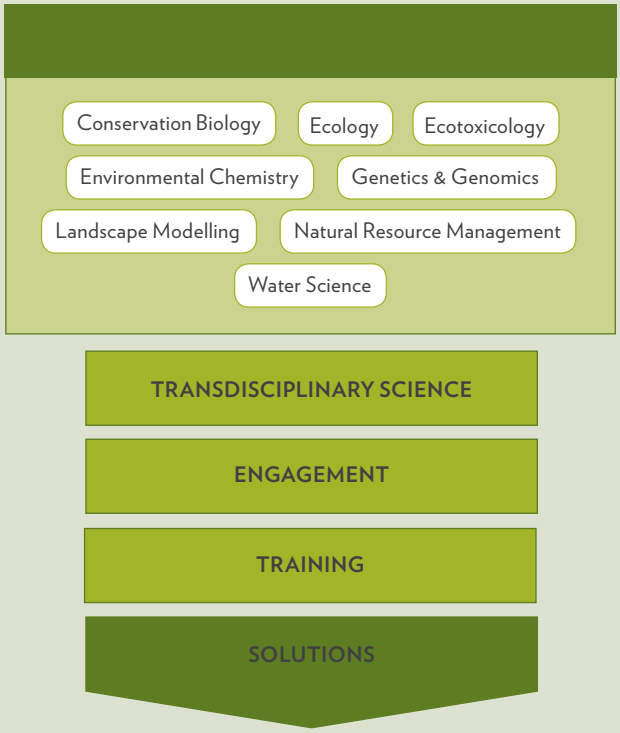

Photo by PhD student Duminda Dussanayake

Q&A WITH SARAH BATES

PHD CANDIDATE

What is your background?
I studied a bachelor of science at Melbourne University, where I majored in botany and environmental studies. For my honours thesis I investigated arsenic transfer through the lower levels of the food chain as part of an overarching research project investigating phytoremediation of mining waste.

After my degree I worked in the environmental sector. Some of my roles included planning and installing wetlands in urban environments, large-scale revegetation projects, and grassland management.

What is your thesis topic?
I am researching the interaction between plants and soil microbes in weed invasion. In particular, if weeds are gaining an advantage from interactions with soil microbe communities.

What drew you to this study?
I was drawn to this topic because of my work in environmental management. Native grasslands in Australia are in decline, estimated to be just 1% of their original extent. Apart from habitat loss, weeds are a big part of this story.

Many invasive species have the potential to transform native grasslands into a degraded weed patch. After years of nutting out management processes and seeing the range of success from the same methods across different plant species, I wondered: what can't I see? What aren't I considering? That's when my interest in soil microbiota began... and here I am!

Why study at the IAE?
I chose the IAE because of the weed invasion research that Professor Richard Duncan and his group are doing. Being able to work with invasion ecologists is a great opportunity. I also like that the IAE has connections with other research and industries groups. This means researchers can see the on-ground problems, and research is integrated where it matters.

What would you like to do after you finish your PhD?
After I finish my PhD I would love to continue on with research. I always have more questions than I have time to answer them.

PHD OPPORTUNITIES IN 2019

Our students are highly valued members of the Institute who contribute greatly to the research environment.

The IAE has over 50 PhD students working on a wide range of research topics. We are looking for more students to work on a number of exciting projects including genetics, conservation biology, environmental DNA, and ecotoxicology. This booklet provides an overview of PhD opportunities in 2019, scholarship information, and more about the institute and our current students.

Students have many opportunities to develop their research skills through activities such as writing workshops, weekly in-house skills development workshops and regular research program meetings. These activities enable students to hone their research skills by exploring testing ideas, as well as analysing and interpreting their data under the mentorship of leading researchers.

Science communication is a vital part of research training. Our students compete in the Three Minute thesis and Pitch for Funds competitions, where they develop the communication skills vital for widely disseminating their research finding and ideas. They also participate in the Institute's seminar series and organize an annual research student conference.

We are committed to training professional and highly employable graduates. The diversity of employment backgrounds and networks of the Institutes staff and adjuncts provide students with opportunities for work-integrated learning and enable them to prepare for a variety of employment roles upon completion of their degrees.

We have a number of PhD opportunities in 2019 outlined on the following pages:

Undergraduate field trip to the Snowy Mountains, NSW. Photo by Associate Professor Duanne White.

Fish Cytogenetics

PROJECT DESCRIPTION

We are seeking at least one, but potentially several, PhD students with interests in molecular cytogenetics and genomics to study karyotype and sex chromosome evolution in Australian freshwater fish species.

Chromosome rearrangements play a critical role in speciation. Karyotypic information from Australian freshwater fish species is poorly studied, having been described from less 20 species. In addition, sex chromosomes and modes of sex determination have not been described from any freshwater species. This project would likely focus on more speciose fish families such as Melanotaeniidae and Percichthyidae.

The project has two broad aims: (i) development of karyotypic resources from selected species from two families of fishes to discover role of chromosome rearrangements in species evolution and divergence, and (ii) discovery of sex chromosomes and development of sex-linked markers in selected species from two families for conservation and management purposes.

THE IDEAL CANDIDATE

The ideal candidate will possess experience in molecular cytogenetics (e.g. cell culture, chromosome preparation, fluorescence in situ hybridization), and genomics (e.g. genomic data mining, experience and familiarization with sequence analyses and NGS technology). Knowledge of chromosome biology and sex determination is desirable. The candidate will be self-motivated and well-organized, with a demonstrated capacity to learn and apply the broad skill set necessary for the successful completion of a research project. The successful candidate will be able to work alongside a wide variety of people in multi-function and multicultural laboratories. The successful candidate(s) will also have a strong commitment to excellence in research and scholarship.

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet).

HOW TO APPLY

Interested applicants are encouraged to make informal enquiries to Professor Tariq Ezaz by 30 July 2018. Please send your curriculum vitae, a sample of your written scientific work, and the names of two referees with a covering letter to Tariq.Ezaz@canberra.edu.au

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Does dynamic ecological change cause rapid evolution?

PROJECT DESCRIPTION

We are seeking PhD students with interests in population genomics and mammal/reptile ecology and evolution to investigate the factors that drive population dynamics and evolution.

Studies documenting evolutionary change have typically focused on the role of strong selection in driving adaptation following abrupt environmental changes. We are applying high resolution genomic analyses to mammal and reptile samples collected from the Simpson Desert annually for the past 12 years to provide insights into the processes that underlie evolutionary change in fluctuating environments and combine these data with long-term demographic data, century-long rainfall records and ecological models. This approach will enable us to understand how climatic fluctuations that drive periodic population pulses act to structure genetic variation and drive rapid evolutionary change.

The projects are supported by an ARC Discovery Grant awarded to a team from the Universities of Canberra, Sydney and Harvard. The successful candidates will be based in Canberra but will be supervised by a cross-institutional panel drawn from Profs Stephen Sarre, Bernd Gruber and Richard Duncan (UC) and Profs Chris Dickman, Glenda Wardle (Usyd).

Candidate 1 will seek to determine the population/landscape genetics of mammal and/or reptile species in the Simpson Desert and across their range in response to dynamic ecological change driven by rare rainfall events. This project will incorporate the collection of historic tissue samples from museums and additional samples from field collection. This project will require significant time in the field collecting samples.

Candidate 2 will conduct theoretical work to model the spatial and temporal graininess of the landscape as it affects geneflow in mammals in an arid environment with a focus on detecting and characterising selection associated with RADseq type markers. A secondary focus will be on how those types of markers can be applied to conservation and management decision frameworks. This project may require some field collection.

Both candidates will possess experience in population genetics/genomics and spatial population modelling. Knowledge of NGS approaches and analyses is desirable. Both candidates will be expected to be self-motivated and well-organized, with the capacity to work in remote locations (including a driver's license) and the broad skill set necessary for the successful completion of a research project. They will be collegial and able to work alongside a wide variety of people in the field and in multi-function teams and will have a strong commitment to excellence in research and scholarship.

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet).

HOW TO APPLY

Interested applicants are encouraged to make informal enquiries to Professor Stephen Sarre by 31 July 2018 at Stephen.Sarre@canberra.edu.au.

Sex in Dragons

PROJECT DESCRIPTION

A major research progam in the IAE is examining the complexities of sex determination and chromosome evolution in dragon lizards. Our central focus is on the Central Bearded Dragon, Pogona vitticeps, which is a remarkable model.

This dragon has a ZZ/ZW system of sex chromosomes (actually sex micro-chromosomes) as in birds that under most circumstances, delivers male and female offspring in equal proportions. The sex chromosomes are differentiated, but largely on the basis of the proliferation of repetitive sequence on the W chromosome – the gene content of the Z and W chromosomes appears to very similar.

So the first challenge is to identify the master sex determining gene for this reptile, and how it is regulated to generate a differential signal for male and female.

Sex in the dragon is also influenced by temperature, in that ZZ individuals can have their developmental trajectory switched from male to female by high temperature. Thus, our dragon provides a unique model for exploring how temperature influences the regulatory processes of sex determination on a background of genetic sex determination.

Applicants for a PhD would join a team of staff and postgraduate students working on these research questions, with ample opportunity to contribute research to address discrete questions of relevance to the broad thrust of this exciting research.

To learn more about the research, visit http://georges.biomatix.org/project/sex-dragons.

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet).

HOW TO APPLY

Enquiries should be directed to Professor Arthur Georges using arthur.georges@canberra.edu.au on or before 31 July 2018.

Q&A WITH SHAYER ALAM

PHD CANDIDATE

What is your background?
I hold a Bachelor degree in Zoology and a Masters in Wildlife Biology from the University of Dhaka, Bangladesh. I also completed a Masters in Biodiversity and Conservation from Stockholm University, Sweden.

I worked as an Assistant Programme Officer at the International Union for Conservation of Nature in Bangladesh, and as a Research Monitoring Officer at the Center for Natural Resource Studies. I am an Assistant Professor in Wildlife and Biodiversity Conservation at Jagannath University in Bangladesh, and I am currently on leave while I complete my PhD at the IAE.

What is your thesis topic?
My PhD topic is "Evolution and Ecology of Sex Determination Mechanisms in Agamid Lizards." I am trying to identify how sex is determined in different Agamid lizard species and what the evolutionary significances behind such phenomena are.

What drew you to this study?
I have a special interest in the genetical aspect of species ecology and conservation. During fieldwork in Bangladesh, I noticed an Agamid lizard laying eggs in its nest and it looked male in appearance! This led me to find out about the sex reversal phenomena and how the environment can influence sex among the offspring in many animals.

Why study at the IAE?
The researchers in IAE are recognised globally for their work in this field, particularly in Agamid lizards, which is why I chose the IAE for my higher degree research.

What would you like to do after you finish your PhD?
I would like to continue my research career in academia.

BIOGEOGRAPHY, SPATIAL PATTERNS AND CONSERVATION OF MARSUPIALS IN THE WORLD

MARGARITA MEDINA, PHD STUDENT

Margarita is from Mexico City, where she completed a Bachelor degree in biology, and a Masters in Biodiversity and Conservation. She then completed a Masters in Biodiversity, Genetics and Evolution in Porto, Portugal.

It was during her undergraduate degree that Margarita became fascinated by marsupials. "My interest was sparked when I found out there were more marsupials than the 'classic' kangaroo and koala. In fact, opossums are native to Latin America, and that there are eight species in my home country of Mexico," said Margarita. "The more I read, the more interested I became. I found out that the migration routes of marsupials were not yet 'solved,' and I thought this would make a good PhD topic."

Margarita is enjoying her research at the IAE, in particular a good working atmosphere, research quality, and the support given to HDR students to attend conferences which helps promote networking with other institutions.

Margarita is considering a number of different career options once she completes her PhD, including applying the tools and software she will develop during her studies to other research projects. Margarita also sees communicating science to students as an important role, and is considering becoming a lecturer.

Unisexual Fish Evolution

PROJECT DESCRIPTION

We are seeking PhD students with interests in evolution and freshwater fishes to study the evolutionary origins of sexually-parasitic 'unisexual' lineages in carp gudgeons (Eleotridae: genus Hypseleotris).

Vertebrate groups that harbour both sexual and unisexual taxa have been highly prized as testing grounds for a range of big-picture questions in evolutionary biology. However, such groups are extremely rare, and none thus far has provided the optimal mix of biological features required to fully explore these questions. Unisexual carp gudgeons represent the first example of sexual parasitism in any Australian vertebrate, one of the few new instances discovered in vertebrates world-wide in over 20 years, and only the fourth vertebrate example of an all-male hybridogen. Essentially these fishes pass on half their genome clonally each generation and are essentially parasitic on sexual species which they rely on to reproduce. Carp gudgeons are among the most abundant native fishes in south eastern Australia, where they comprise ~6 sexual species (three of which are undescribed). Four of these sexual species are known to mate with (and thus help perpetuate) sexually parasitic lineages, while another "species" (Lakes carp gudgeon) is currently primarily only known from its genetic signature in some unisexual lineages (i.e. the sexual ancestor is almost extinct). Ecologically these fishes offer great opportunities for research, since multiple sexual and unisexual forms often occur at the same site, both in the Murray-Darling Basin and the coastal drainages along central eastern Australia. Research into the ecology and evolution of these fishes remains limited, so all new investigations will be ground-breaking.

The options for the specific PhD research questions are wide open including, but not limited to the following topics: their reproductive biology (who mates with who); their ecology in the wild (how are so many different sympatric forms dividing up resources); environmental preferences of the various species and hemi-clonal forms; genetic patterns (especially characterising their genomes); conservation of one endangered species; behavior; differences in parasites or any topic of interest and relevance.

The successful candidate will be working with primary supervisor Dr Peter Unmack and other fishy and evolutionary biologists at UC depending on the nature of the project.

THE IDEAL CANDIDATE

The ideal candidate will possess an interest and some experience working with fishes. Depending on the project some fieldwork may be required, the candidate must be able to drive, ideally with some 4wd experience. The candidate will be self-motivated and well-organized, with a demonstrated capacity to learn and apply the broad skill set necessary for the successful completion of a research project. The successful candidate will be able to work alongside a wide variety of people in multi-function and multicultural laboratories. The successful candidate(s) will also have a strong commitment to excellence in research and scholarship.

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet).

HOW TO APPLY

Interested applicants are encouraged to make informal enquiries to Dr Peter Unmack by 31 July. Please send your curriculum vitae and the names of two referees with a covering letter Peter.Unmack@canberra.edu.au.

Environmental DNA (eDNA) for multi-species detection in Australian freshwater systems

PROJECT DESCRIPTION

The ability to analyse eDNA with high-throughput sequencing allows for multiple taxa identification simultaneously from a single sample using metabarcoding. Metabarcoding is especially useful for discerning non-target, or unanticipated taxa. Although this approach is promising, and we have demonstrated the ability of this method to detect fish species from eDNA samples in river systems, a quantifiable framework has not been established and validated as is the case with single-species detection. For this method to be applied for surveillance and border-detection, challenges such as identifying discriminatory DNA markers, understanding likely bias from PCR and sequencing need to be overcome.

We are seeking expressions of interest from suitably qualified, self-motivated students to undertake a PhD as part of an interdisciplinary team conducting research on environmental DNA (eDNA) detection in order to develop a quantitative framework for multi-species detection. The project will utilise metabarcoding techniques for ecological community assessment in freshwater systems as part of a project funded through the Centre for Invasive Species Solutions (http://www.invasives.com.au).

THE IDEAL CANDIDATE

Applicants must have: a First Class Honours or four years of undergraduate study coupled with a publication record to establish first class equivalence, some experience in the application of genetic techniques especially involving trace DNA, bioinformatics skills and demonstrable interest and general knowledge in aquatic invasive species, and personal attributes conducive to working constructively and productively as part of research team. Willingness to conduct fieldwork in remote locations is also desirable.

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet). A "top up" scholarship is also available through the Centre for Invasive Species Solutions.

HOW TO APPLY

Interested applicants are encouraged to make informal enquiries to Associate Professor Dianne Gleeson (Dianne.Gleeson@canberra.edu.au) and Dr Elise Furlan (Elise.Furlan@canberra.edu.au) by 31 July 2018.

GUARDIANS OF THE GALAXIAS: INVESTIGATING THE ECOLOGY OF STOCKY GALAXIAS

HUGH ALLAN, MASTERS CANDIDATE

Stocky Galaxias (*Galaxias tantangara*) were first described in 2014 in a small alpine stream in Kosciuszko National Park. Not much is known about the species, so Masters student Hugh Allan is working to discover more about their ecological requirements to aid in their conservation campaign.

Each month Hugh travels to the high country in Kosciuszko National Park to sample the only known population of Stocky Galaxias. Using backpack electrofishing, Hugh temporarily stuns the fish making them easier to catch. "We measure and weigh the fish, and inspect them for signs of disease, parasites and health condition," explains Hugh. A small sample of fish are brought back to labs at the IAE to determine reproductive development and age.

Fish are also tagged, and Hugh uses a portable tag detector to monitor fish locations. "We wade up the stream using a purpose built long-range antenna to determine precise fish locations. We compare this information to those collected previously to see how far fish have moved since we last detected them, and what sort of habitat they are using," says Hugh.

It's not all hard work though, once surveys are complete the focus shifts to fishing, spotlighting, exploring historic huts, and camping in some pretty special places.

Masters student Hugh Allan using a portable tag detector to determine the exact location of Stocky Galaxis.

Freshwater Fish Conservation Biology

PROJECT DESCRIPTION

We are seeking PhD students with interests in freshwater fishes. We study a wide variety of species and topics, but with a bit more focus on threatened species such as Macquarie Perch, Running River Rainbowfish, Red-fin Blue-eye, Galaxiids, etc.

The options for the specific PhD research questions are completely wide open including, but not limited to topics such as aspects of a species ecology and biology, reproduction, diet, interactions with alien species, conservation translocations, phylogeography, etc. Basically anything that relates to freshwater fishes is likely suitable.

The successful candidate will be working with primary supervisors Dr Peter Unmack and Mark Lintermans and other biologists at UC depending on the nature of the project.

THE IDEAL CANDIDATE

The ideal candidate will be willing to live, breath and think like a fish! They will likely need to spend considerable time in the field in remote locations, must have experience driving vehicles (ideally 4wd). The candidate will be self-motivated and well-organised, with a demonstrated capacity to learn and apply the broad skill set necessary for the successful completion of a research project. The successful candidate will be able to work alongside a wide variety of people in multi-function and multicultural laboratories. The successful candidate(s) will also have a strong commitment to excellence in research and scholarship.

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet).

HOW TO APPLY

Interested applicants are encouraged to make informal enquiries to Dr Peter Unmack and Mark Lintermans by 31 July 2018. Please send your curriculum vitae and the names of two referees with a covering letter to Peter.Unmack@canberra.edu.au and Mark.Lintermans@canberra.edu.au.

Researchers looking for Running River Rainbow fish in the Running River, Queensland. Photo by Mark Lintermans.

USING GENOMICS FOR CHEETAH CONSERVATION

DAVID THUO, PHD CANDIDATE

Cheetahs are an iconic animal of the African plains. Conflict with humans is one of many pressures leading to a drastic decline in numbers. Local land owners see cheetahs as a threat to domestic livestock, and will kill them to protect their animals. But maybe cheetahs are not the culprit?

Research student David Thuo is collecting scats from Kenyan cheetahs and will use genetic analysis to determine their diet, as well as taking tissue samples to develop a high resolution genetic tool that can be used to differentiate cheetahs and assess their health and population structures. David hopes this information will be used to influence cheetah management policy and education programs.

Having spent years in the bush monitoring rhinos, cheetahs and lions, David thought his PhD field work would be a walk in the park. "While my field work was hugely successful, it was equally challenging," says David. "It wasn't just the technical aspect that was challenging.

I also collaborated with various local government and conservation groups, and spent two weeks training research assistants on cheetah identification, data and sample collection and sample preservation."

David's days in the field usually involved cheetah spotting or travelling long distances between sites. "A typical day would start at 4:30 am when temperatures are low and the chances of sighting a cheetah is high. We would wait until the cheetah dropped poo which we would collect, or the wildlife veterinary arrived to take a biopsy. This could take up to 10 hours. We would also take a cheetah ID photo, and record other data such as location, body condition, sex etc." The cheetahs didn't always cooperate, however. Some days David wouldn't find any of the big cats, or was unable to take a sample for various reasons. "But I always had fun watching the other wild animals, and breath-taking predator hunts."

When David wasn't observing cheetahs he would drive long distances between sample sites, or transport samples collected by different organisations to the Institute of Primate Research in Nairobi for preservation.

Developing cellulosic fibres as biosorptive material of heavy metals in waterways

PROJECT DESCRIPTION

Plant cellulosic fibre offers a mean to improve the quality of waters contaminated with heavy metals. It has been shown that industria hemp fibre can be used as an indicator of environmental pollution in aquatic ecosystems.

However, little is known on how the metal composition in the cellulosic plant tissue can affect the fibre biosoprtive potential. Plant fibres that accumulate large amounts of metals may be utilised as sustainable biosorptive materials to improve the quality of water around urbanised areas.

We are looking for motivated candidates to pursue PhD research with us in this exciting field. This research project will consist of a combination of laboratory and greenhouse experiments, as well as field work.

This project contributes to better understanding the application of natural fibres in the cleaning of water contaminated with heavy metals with the overall aim of resolving environmental issues of water contaminated with heavy metals in urban areas around Australia.

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet).

HOW TO APPLY

Interested applicants are encouraged to make informal enquiries to Associate Professor Simon Foster by 31 July 2018. Please send your curriculum vitae and the names of two referees with a covering letter to simon.foster@canberra.edu.au.

Using metal-tolerant hemp varieties for mine site rehabilitation

PROJECT DESCRIPTION

Metal tolerant plants have the ability to store and/or restrict the translocation of large amounts of metal(s) to above ground tissues. *Cannabis sativa L.* (industrial hemp) is a fast-growing plant species with a long tap root system that can be used in the stabilisation of mineral waste as a result of mining. In recent years, research has been focused on investigating synergistic possibilities by using high value crops such as hemp for rehabilitation of heavy metal contaminated sites. It represents a simple, economic, environmentally friendly approach to cultivate high value industrial hemp varieties on non-arable land while ameliorating the toxic effects of heavy metal pollution. Currently, little is known on the toxicity threshold values of heavy metals for *Cannabis sativa L.* and therefore the potential of using industrial hemp in mine site rehabilitation. Furthermore, there is no information on the mechanisms of metal tolerance in *Cannabis sativa L.* We are looking for motivated candidates to pursue PhD research with us in this exciting field. This research project will consist of a combination of laboratory and greenhouse experiments, as well as field work. This project contributes to better understanding the application of high value crops such as industrial hemp to alleviate concerns associated with heavy metal toxicity due to mining and add value to the process of mine site rehabilitation.

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet).

HOW TO APPLY

Interested applicants are encouraged to make informal enquiries to Associate Professor Simon Foster by 31 July 2018. Please send your curriculum vitae and the names of two referees with a covering letter to simon.foster@canberra.edu.au

Professor Bill Maher sampling for antimony.

Q&A WITH TUTI SIREGAR

PHD CANDIDATE

What is your background?
I completed a Bachelor degree in Chemistry with honours from Gadjah Mada University, Yogyakarta, Indonesia, then continued my studies with a Masters degree from James Cook University. I have taken leave from my job at the Ministry of Marine Affairs and Fisheries in Indonesia to complete my PhD here at the IAE.

What is your thesis topic, and what drew you to it?
My thesis is about arsenic metabolism in marine organisms. I chose this topic is because I am concerned about marine pollution and the safety of seafood consumption, especially in Indonesia. Arsenic is ubiquitous in marine organisms, and while most arsenic species in seafood are identified as non-hazardous, their presence in marine organisms is still worrying.

What do you like about the IAE?
There is strong support between staff and students at the IAE, which has really helped my study. There are lots of activities we can participate in to help us prepare during our research journey, such as the writing club, weekly seminars, and the HDR conference.

What would you like to do after you finish your PhD?
I will return to my role as a researcher in the Ministry of Marine and Fisheries in Indonesia. I hope to maintain my good relationships with my IAE colleagues and friends.

QUANTIFYING BIVALVE HEALTH

JILL BARTLETT, PHD CANDIDATE

Jill completed an undergraduate degree at the University of Canberra in 2003, and returned to study metal contamination in food webs for her honours thesis in 2007-08. Jill returned again in 2012, this time as a PhD student investigating how energy storage can be used as a biomarker of environmental stress.

"I was drawn to this topic from my interest in ecochemistry and toxicology. I think being able to quantify the effects of stress on an ecosystem is an important tool for ecosystem management," says Jill. "I've established new methods that make measuring energy much faster, and therefore a more viable tool in the future."

Jill finds the IAE a welcoming and exciting place to study, in particular the people and the dynamic energy involved in research. However it's not all academic with Jill. In between her studies Jill worked for local and federal government, including ten years with Defence undertaking environmental risk management, and had three children along the way.

Considering her wide experience in research and public service, Jill sees her future career applying research to real world environmental management decisions.

Formation of metalloid nanoparticles by plants

PROJECT DESCRIPTION

Plants have been shown to form nanoparticles of dissolved gold and silver. While it's been shown that several species of plants can form metallic nanoparticles the underlying biochemical mechanisms are poorly understood. This project would involve isolating the main chemical components from several different plant species and determine which bioactive compounds aid in the formation of nanoparticles to try and establish the main biochemical routes. We are looking for motivated candidates to pursue PhD research with us in this exciting field. This research project will consist of a combination of laboratory, isolation and characterisation of bioactive compounds as well as some and greenhouse experiments. This project contributes to better understanding the natural formation of nanoparticles in the environment and aid in better understanding the environmental issues of nanoparticles in plants and their potential trophic transfer.

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet).

HOW TO APPLY

Interested applicants are encouraged to make informal enquiries to Associate Professor Simon Foster by 31 July 2018. Please send your curriculum vitae and the names of two referees with a covering letter to simon.foster@canberra.edu.au

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Q&A WITH FAYHA AL-SHIBLI

PHD CANDIDATE

What is your background?
I have a Bachelor degree in Agricultural Resources and Environment (Irrigation), and a Masters degree in Environmental Studies, both from the University of Jordan. For my thesis I investigated the main constraints of conducting Rio environmental conventions in Jordan. I also worked as a researcher at the Ministry of Water and Irrigation / Jordan and Ministry of Agriculture/Jordan

What is your thesis topic?
I am modelling the future water budget in Jordan, and evaluating the major stressors affecting water availability. Climate change, population growth and groundwater over-abstraction are the main pressures I am analysing.

What drew you to this study?
Jordan is one of the poorest countries with regard to water resources. I am from Jordan, and am passionate about helping this situation. I hope the information generated through my thesis can be used to support decisions for Jordan's water security.

Why study at the IAE?
My supervisors, Professor Bill Maher and Professor Ross Thompson, are very supportive of my research, and the work environment here is very positive. The IAE has also offered me the opportunity to learn about hydro-climatological studies, which I am really enjoying.

What would you like to do after you finish your PhD?
I am still affiliated with the School of Agriculture at the University of Jordan, so when I finish I will return there and continue teaching.

How does daily and seasonal temperature variability affect biodiversity?

PROJECT DESCRIPTION

Predicting effects of changes in climatic conditions on the distribution of species remains highly challenging. Climate change is predicted to increase both mean temperature and variability in temperature, and it is critical to have a strong mechanistic understanding of how organisms are likely to respond to future thermal environments. The Climate Variability Hypothesis (Janzen 1967) relates seasonal thermal variability to species' distributions, thermal niches, dispersal ability and population genetic structure. Other hypotheses consider how daily and other shorter term temperature variability affects organisms' thermal tolerance and performance. At least two PhD projects will be offered to test these hypotheses using freshwater invertebrate communities along elevation gradients at different latitudes in Australia and compare to existing data from the Americas. Supervisor for these projects are Associate Professor Ben Kefford, Professor Ross Thompson, Professor LeRoy Poff, Professor Jane Hughes (Griffith University) and Professor Damien Burrows (James Cook University).

THE IDEAL CANDIDATE

The ideal candidate will have experience in one or more of the following areas: Ecology, Freshwater Biology, Ecophysiology or Population Genetics.

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet). A top-up scholarship and project funding is through an existing ARC grant.

HOW TO APPLY

Interested applicants are encouraged to make informal enquiries to Associate Professor Ben Kefford (Ben.Kefford@canberra.edu.au) by 31 July 2018.

Diagnostic biomonitoring to detect the effects of specific stressors on stream macroinvertebrate communities

PROJECT DESCRIPTION

This project will determine if it is possible to determine the cause of degraded macroinvertebrate communities based on the traits that taxa in the community. Current river health assessment methods do not diagnose specific causes of impairment. The project aims to improve river health bioassessments by developing innovative and low cost methods to identify specific causes of ecological degradation, enabling the design of cost-effective, targeted management interventions to improve river condition. The goal is to develop indices that can transform monitoring by offering rapid diagnostic capacity and cost-effective invertebrate species identification. Supervisors for this project are Associate Professor Ben Kefford, Dr Sue Nichols, and Dr Jon Bray.

THE IDEAL CANDIDATE

The ideal candidate will have experience in one or more of the following: Ecology, Freshwater Biology, Ecophysiology or Ecotoxicology.

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet). Project funding is through an existing ARC grant.

HOW TO APPLY

Interested applicants are encouraged to make informal enquiries to Associate Professor Ben Kefford (Ben.Kefford@canberra.edu.au) by 31 July 2018.

Dr Sue Nichols kick sampling for macroinvertebrates.

Environmental variability and population dynamics of kangaroos

PROJECT DESCRIPTION

We are looking for a motivated and capable student, with a keen interest in both population dynamics and fieldwork, for a PhD program on the population dynamics of Eastern Grey Kangaroos. The selected candidate will build upon an existing 10 years of population estimates and individually-based data on survival, growth and reproduction of over 1000 kangaroos in a population in Victoria. We are looking for a person with a strong academic record, good quantitative skills and an interest in both fundamental and applied aspects of population dynamics in a highly variable environment. Previous research experience and demonstrated ability to do fieldwork are essential. The ideal candidate will also have published previous research and be competitive for scholarships.

The program will be co-supervised by Richard Duncan at the University of Canberra, Marco Festa-Bianchet at the Université de Sherbrooke, and Dave Forsyth at New South Wales Department of Primary Industries.

The program will involve a detailed quantification of the drivers of population change over time, including weather, vegetation productivity and kangaroo population density. In addition, the data will allow a detailed decomposition of changes in population size into effects of reproduction, age- and sex-specific survival, and possibly cohort effects.

Further information on the kangaroo research and previous publications are available at http://marco.recherche.usherbrooke.ca/marco.htm

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet).

HOW TO APPLY

Interested applicants are encouraged to make informal enquiries to Centenary Professor Richard Duncan (Richard.Duncan@canberra.edu.au) by 31 July 2018.

Cost-effective management strategies for wild deer in Australia

PROJECT DESCRIPTION

We seek a motivated and capable student, with a keen interest in wildlife management and population dynamics, for a PhD program investigating cost-effective management strategies for wild deer in Australia. The selected candidate will conduct original research to evaluate the costs and benefits of deer management strategies including ground-shooting, aerial shooting and fencing. The program will involve analysis of data collected in deer control programs conducted by state and local government agencies, quantifying the costs of this control and modelling the long-term impacts of this control on deer populations.

We are looking for a person with a strong academic record and previous research experience. The ideal candidate will also have published previous research and be competitive for scholarships. Both domestic and international students are eligible to apply. The PhD program will be co-supervised by Professor Richard Duncan at the University of Canberra and Dr David Forsyth at the New South Wales Department of Primary Industries.

SCHOLARSHIP

Applications for financial support for a domestic or international student will be applied for through University of Canberra scholarship round (see page 17 of this booklet). The Australian Centre for Invasive Species Solutions (CISS) would fund: (1) a top-up scholarship of $5,000 for each of the first seven semesters; (2) a full scholarship for the eighth semester; (3) operating costs of $7,000 annually for four years; (4) conference attendance of up to $3,500 annually.

HOW TO APPLY

Interested applicants are encouraged to make informal enquiries to Centenary Professor Richard Duncan (Richard.Duncan@canberra.edu.au) or Dave Forsyth (Dave.Forsyth@dpi.new.gov.au) by 31 July 2018.

SCHOLARSHIP INFORMATION

OVERVIEW

RTP Scholarships will be awarded to a limited number of students (domestic or international) across the University where applicants display exceptional research potential to undertake a Doctor of Philosophy course. Recipients are selected through a competitive selection process based on academic merit and research potential.

SCHOLARSHIP ELIGIBILITY

To be eligible, candidates should have:

- completed a Bachelor degree with First Class Honours, or be regarded by the University as having an equivalent level of attainment;
- be enrolled or seeking to enroll as a full-time candidate in a Doctor of Philsophy course at the University;
- be an Australian or New Zealand citizen, or an Australia permanent resident,
- or an international student eligible to study in Australia on an international student visa.

SCHOLARSHIP CONDITIONS

The scholarship provides a fortnightly tax free stipend to assist with general living costs for up to three years. The level of the stipend will not be reduced during the period of award and is indexed annually. The 2018 rate is $AUD27,082. In addition, scholarship recipients are eligible for an allowance for relocation and thesis production.

If the awardee is an international student, they are eligible for overseas health cover (single only). The scholarship may also be accompanied by a tuition fee sponsorship for up to three years, which is provided at the discretion of the University Scholarships Committee.

ENGLISH LANGUAGE REQUIREMENTS

The University of Canberra scholarships are open to all nationalities. However, overseas candidates for whom English is not a first language must secure an IELTS score of 6.5 and have no individual score falling below 6.0 to satisfy our English language requirements. More information can be found at canberra.edu.au/future-students/research-students/english-proficiency

Applications close 30 September 2018. **It is expected that students will contact the supervisor listed in the project descriptions to determine whether they are a suitable candidate. The supervisor will then work with the prospective student to apply for a scholarship.**

More information on the scholarships and admission process can be found at canberra.edu.au/future-students/scholarships-and-financial-support/scholarships-and-fees

IAE RESEARCH STRENGTHS

Our researchers span a broad range of expertise, and we regularly collaborate across disciplines to solve environmental problems.

CONSERVATION ECOLOGY

Our conservation ecology team carries out research that underpins environmental management, providing knowledge and tools to manage threats to Australia's native biodiversity. Our research focuses on how plant and animal communities function, and their response to changes such as land transformation, the spread of alien species, climate change, fire and nutrient cycles. This knowledge is applied to effectively manage or mitigate these impacts.

Image: Measuring habitat characteristics in native grassland communities to find out what might make some rocks more appealing to the endangered grassland earless dragon (*Tympanocryptis pinguicolla*), Monaro region, NSW. Photo by Anna MacDonald.

WATER SCIENCE

Our water science team aims to increase our understanding of freshwater systems to inform management and policy decisions. Our researchers study the fundamental ecology of Australia's freshwater systems, from stream metabolic processes, to endangered native freshwater fish. This knowledge is applied to environmental problems such as management of environmental flows, effects of water pollution, impacts of land-use and climate change. Our team works across disciplines, research organisations and agencies to generate integrated solutions to water science challenges.

Image: In 2010 the IAE began an ongoing assessment program to determine the impact of inundation and operation of the Cotter Reservoir increase in capacity from 4 to 78 GL on two threatened fish species – the Two-spined blackfish (*Gadopsis bispinosus*) and Macquarie perch (*Macquaria australasica*). Photo by Ugyen Lhendup.

GENETICS AND GENOMICS

Our genetics and genomics research brings the power of DNA technologies to bear on central questions in ecology and evolution. We engage in detailed examination of epigenetic factors in plants and animals to unveil the mysteries surrounding the interaction of genes and the environment. By combining genetic and genomic analysis with whole organism and field studies we can discover the role genetic processes have in determining basic life histories and characteristics such as sex determination or disease resistance.

Image: IAE researchers are unravelling the mystery surrounding sex determination in bearded dragons (*Pogona vitticeps*) and other reptiles. They discovered male dragons can become female – a process called "sex reversal" – when subject to extreme temperatures. Photo by Stephen Sarre.

ENVIRONMENTAL DNA

Environmental DNA (eDNA) is increasingly being used in surveys to establish the presence or absence of target species at sampling sites. Institute researchers have used this detection method for a range of invasive aquatic species, including redfin perch and carp. We have also developed a method for the detecting the threatened Macquarie perch spawning, shown that eDNA can detect the presence of terrestrial vertebrate species at water sources. Environmental DNA is gaining popularity as a detection tool in difficult-to-survey locations, such as aquatic habitats, and for difficult-to-detect taxa, such as rare or cryptic species.

Image: Spawning of the threatened Macquarie perch has been detected by IAE researchers by comparing the abundance of different types of eDNA produced during the spawning period. This application can help evaluate management actions aimed at increasing the reproductive output of endangered populations. Photo by Ben Broadhurst.

WILDLIFE GENETICS

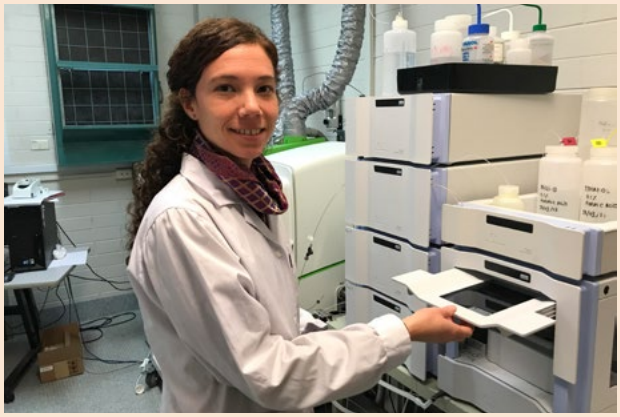
The wildlife genetics team have a broad range of expertise from traditional population genetics through to eDNA and genomic tools. Applying DNA technologies for biodiversity and conservation outcomes is a prime focus of the team. The group combines genomic trace DNA and DNA genotyping to probe the historical phylogeography of Australasian fauna and to solve problems of forensic and ecological importance. End users of this science include conservation management agencies, environmental regulatory authorities, and other research institutions.

Image: The presence of foxes (*Vulpes vulpes*) in Tasmania has been hotly debated. Researchers from the IAE used DNA analysis of predator scats (faeces) to detect its presence across northern and eastern Tasmania. The distribution of foxes was determined using systemic survey of potentially suitable habitat. This information was used to develop and implement a broad-scale fox baiting and monitoring program.

ENVIRONMENTAL CHEMISTRY AND ECOTOXICOLOGY

Our environmental chemistry and ecotoxicology researchers have renowned expertise in freshwater and marine chemistry, nutrients, metal and metalloid cycling through aquatic ecosystems, and ecotoxicology. Of special interest to the group are the transport and fate of elements in the environment, including water, sediment, dust and biota, focussing on element speciation. Our researchers are experienced in the sampling and analysis of a wide range of sample types, and have a well-equipped environmental chemistry and toxicology facility.

Image: Researchers at the IAE are working to understand the fundamental science underpinning the metabolism pathways of organic arsenic species. This work is an important first step in understanding the risk associated to arsenic exposure. Photo by Teresa González de Chávez Capilla.



RESEARCH FACILITIES

E2R AQUATIC MESOCOSM ARRAY

The E2R (Education, Engagement and Research) facility was largely completed in 2017, and provides ten 2500L recirculating streams for experimental research. The largest facility of its type in Australia, E2R will provide facilities for undergraduate projects, graduate research, and a range of research projects in environmental chemistry, ecotoxicology, fish biology and freshwater ecology.

FRESHWATER ECOLOGY LABORATORY

The Freshwater Ecology Laboratory has the capacity for the analysis of macro invertebrate and fish samples, algae and stable isotope samples, as well as a range of habitat characterisation parameters.

The Laboratory contains a range of Leica microscopes, micro balances mutiprobe meters and data loggers as well as instruments for measuring water quality, algal biomass and chlorophyll concentration.

ECOCHEMISTRY LABORATORY

The Ecochemistry Laboratory is a highly specialised laboratory undertaking analysis of chemical species in biological tissues, waters and sediments from aquatic ecosystems.

The Laboratory undertakes full chemical speciation analysis in water, sediments, soil, animal and plant tissues. We have particular expertise in arsenic, mercury and selenium speciation.

WILDLIFE GENETICS LABORATORY

The Wildlife Genetics Laboratory allows researchers to undertake high quality DNA research through the use of separate pre- and post- PCR space equipped for DNA sequencing, genotyping, cloning, and state-of-the-art cytogenetic work.

EPIGENOMICS LABORATORY

The Epigenomics Laboratory complements the high quality research undertaken in the Wildlife Genetics Laboratory. It is equipped to perform epigenetic and epigenomic studies, from the level of entire genomes or chromosomes down to individual genes, on model and non-model species for biomedical and ecological research projects.

The facility consists of dedicated laboratories for cell culture, molecular cytogenetics and fluorescence microscopy, as well as a large main laboratory with 16 individual work spaces and communal equipment benches.

COSMOGENICS FACILITY

The Cosmogenics Facility is a purpose built facility equipped with a robotic Vulcan 84 automated sample preparation system that enables acid digestion of solid and liquid samples.

The Cosmogenics Facility enables research into cosmogenic nuclide dating of geological samples, general analysis of environmental soil and sediment, complementing the Ecochemistry Laboratory, and fatty acid analysis of fish and macroinvertebrates.

GLASSHOUSE

The Glasshouse is a state-of-the-art auto grow facility with an 'on the go' mobile platform and comprehensive climate controls that enable researchers to cultivate their research in a measurable environment. The Glasshouse facility also contains an in-built alarm system that sends alerts if there are any deviations to set climate measures.

GEOGRAPHIC INFORMATION SYSTEM AND ECOLOGICAL MODELLING LABORATORY

The Geographic Information System and Ecological Modelling Laboratory is a highly specialised IT Laboratory equipped with high-end computers comprising of ARCGIS and other modelling software. This assists our researchers through parallel computations to manipulate, simulate and model their research with ability to facilitate the production of maps.

TRACE DNA LABORATORY

The Trace DNA Laboratory is isolated from all other DNA work related buildings to enable researchers to undertake DNA work used for genetic analysis of samples where DNA quantity is low and the potential for contamination significant.

RESEARCH VEHICLES/VESSELS

The Institute maintains a fleet of fully equipped four-wheel drive vehicles, boats, remote controlled electrofishing vessel and trailers to support our researchers throughout their time in the field during research collection periods. The Institute has recently rejuvenated its vehicle fleet, acquiring two brand new fit for purpose vehicles. These vehicles and trailers have the ability to go fully off road and reach remote areas.

ANTHONY DAVIDSON

PHD STUDENT

Anthony Davidson is the inaugural recipient of the David Choquenot Memorial scholarship. He has a strong background in modelling population dynamics, and will expand on this knowledge using a Bayesian Framework for his PhD studies.

As a New Zealander, Anthony was drawn to the Institute as the David Choquenot Memorial scholarship has strong links with industry (LandCare Research: Manaaki Whenua) and New Zealand ecosystem research. For his thesis, he will investigate the population dynamics of interacting invasive species in New Zealand forests.

Once Anthony finishes his PhD studies he would like to continue with statistical research, ideally applying ecological modelling tools to species of high conservation or economic value. Since joining the IAE, Anthony has enjoyed being part of a small group of dedicated researchers, and has benefited from the opportunity to learn from visiting high profile international ecologists.

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