The Murray–Darling Freshwater Research Centre

Honours and Post Graduate Research 2018

A Guide for Honours and Post Graduate Research Studies under the supervision of staff at La Trobe University and The Murray–Darling Freshwater Research Centre

July 2017

Table of contents

INTRODUCTION

The MDFRC is a partnership between **La Trobe University** and **CSIRO**, with additional collaboration agreements with the Murray–Darling Basin Joint Governments and University of Canberra.

The Murray–Darling Freshwater Research Centre has experience and provides expertise in:

Chemistry & biogeochemistry
Aquatic Ecotoxicology
Wetland and floodplain vegetation
Fish population biology and physiology
Invertebrate ecology
Ecological modelling
Floodplain ecology

MDFRC provides strategic advice and solutions to Government agencies and water managers as well as collaborate with other research organisations. MDFRC has a vast knowledge of the Murray–Darling Basin and has worked in various other areas of Australia and overseas in an effort to optimise management decisions and increase research efforts in freshwater ecology.

We have 30 dedicated staff across two sites located at La Trobe University in Wodonga and Mildura and work closely with CSIRO and the Department of Ecology, Environment and Evolution to offer our clients a broad professional ecological knowledge base to accommodate all aspects of research.

CONTACT US

MDFRC La Trobe University Albury-Wodonga Campus
Campus
Nancy Millis Building 8
133 Mc Koy Street
PO Box 821
Wodonga Victoria 3690
P: 02 6024 9650
E: mdfrc@latrobe.edu.au | **W:** www.mdfrc.org.au

MDFRC La Trobe University Mildura

Brian Grogan Building
471 Benetook Avenue
PO Box 4095
Mildura Victoria 3502
P: 03 5051 4050

HONOURS PROGRAM

La Trobe University

The primary focus of an Honours year is training in research of your chosen field. Your course will involve a mix of advanced theory, research training and a research project leading to a thesis.

The minimum entry requirement is a three year Bachelor Degree with a B grade average (marks of 70-79%) in subjects relating to your Honours degree.

http://www.latrobe.edu.au/study/undergrad/how-to-apply/direct/honours

For further information, please contact the La Trobe University / MDFRC Regional Coordinator Aleicia Holland A.Holland2@latrobe.edu.au

POST–GRADUATE STUDIES

La Trobe University Graduate Research

Doctor of Philosophy (PhD) studies can be undertaken under the supervision of staff within the centre. The award of a PhD degree depends on the examination of a completed thesis of typically 80,000 words or less (although there can be differences depending on your field of research). The designated maximum period of study is four years full-time, or equivalent part-time, and candidates must gain through their studies (and demonstrate in their thesis) a substantial body of knowledge at the frontier of a field of work or learning, including knowledge that constitutes an original contribution. Our La Trobe PhD may be tailored to provide candidates with more industry experience.

To be eligible for any scholarship from the MDFRC–MDBA Collaboration Project students must first obtain either:

- La Trobe University Postgraduate Research Scholarship
- International Postgraduate Research Scholarship

Information on these scholarships can be located at **www.latrobe.edu.au/research/future/apply** . Applications for candidature close 30 September 2017 for International applicants and 31 October for domestic.

Australian and New Zealand Students

- To qualify for a La Trobe University (LTU) PhD scholarship, candidates must attain an Honours (or 'Honours equivalent') score of 80% or above.
- For candidates from Australian or New Zealand institutions Honours marks are accepted without further modification.

International students

- International applicants, who typically will have completed a Master degree will be assessed for 'Honours equivalence' in the Australian system. The weighting applied in this instance is 30% coursework and 70% thesis, regardless of the weighting in the original Masters program.
- As a general guide international students will need to have achieved a Grade Point. Average (GPA) of 80% for both coursework and thesis components, with the thesis examined (and marked) independently by a LTU academic staff member.
- International candidates may also be required to provide evidence of academic English proficiency prior to commencement of their studies.

The awarding of La Trobe University postgraduate scholarships and "top-up" scholarships are a competitive process. The achievement of the required Honours (or equivalent) grade does not automatically result in the awarding of a scholarship.

MDFRC – MDBA COLLABORATION SCHOLARSHIPS

The Murray–Darling Freshwater Research Centre (MDFRC) in association with The Murray–Darling Basin Authority (on behalf of the joint governments) is committed to the generation and adoption of freshwater ecological knowledge to inform decision making.

The MDFRC and MDBA Collaboration Partnership (MMCP) invites applications for “top–up” scholarships to support Post Graduate students undertaking research on the ecology and biogeochemistry of floodplain rivers and wetlands. Research themes that are considered within scope for consideration include:

- Plant ecology
- Floodplain fish ecology
- Food web ecology
- Invasive aquatic species

As well as a stipend top–up and operating funds to support travel and fieldwork, successful applicants will engage with state and federal water policy and management representatives with the aim of enhancing their understanding of evidence–based decision making.

Applicants must have been successfully awarded a La Trobe University Postgraduate Research Scholarship or International Postgraduate Research Scholarship (IPRS)
http://www.latrobe.edu.au/research/future/apply

Students will be based at The Murray–Darling Freshwater Research Centre (MDFRC) at either the Albury–Wodonga or Mildura campuses of La Trobe University. MDFRC specialises in the ecology of rivers and wetlands within the Murray–Darling basin. See:
http://www.mdfrc.org.au/

PhD Top–Up Scholarship

Through La Trobe University the MMCP will provide “Top–up” scholarships to successful PhD applicants to the value of $15,000 ($10,000 “top–up” + $5,000 operating) per annum.

How to apply

If you wish to apply for one of the three potential scholarships visit:
http://www.mdfrc.org.au/students/scholarships/Phd.asp for the MDFRC PhD Top–Up application form. Submit the application form to mdfrc@latrobe.edu.au**Closing date**

Closing Date

Application dates close 30th January 2018. Applicants will be advised of an outcome early February 2018

Contact us

For further information, please contact: Dr Daryl Nielsen, Principal Research Scientist, Murray–Darling Research Centre **d.nielsen@latrobe.edu.au**

Honours Scholarship

Through La Trobe University the MMCP will provide an Honours scholarship to successful applicants to the value of $6,000 ($4,000 stipend + $2,000 operating). These scholarships will be selected based on the students undergraduate course Weighted Average Mark (WAM) and the relevance of Honours project to the MMCP.

Honours students will be supervised/co-supervised by MMCP researchers and will undertake a research project aligned with the objectives of the MMCP. These positions will be based at The Murray–Darling Freshwater Research Centre (MDFRC) at either the Albury–Wodonga or Mildura campuses of La Trobe University.

Applicants must be enrolled or in the process for applying through La Trobe University for the Honours Program, details at **http://www.latrobe.edu.au/courses/science/honours**

How to apply

If you wish to apply for one of the three potential scholarships visit; **http://www.mdfrc.org.au/students/scholarships/Honours.asp** for the MDFRC Honours Scholarship Information Sheet. Submit an application to **mdfrc@latrobe.edu.au**

Closing date

Application for second round close 30 January 2018.

Contact us

For further information, please contact: Dr Daryl Nielsen, Principal Research Scientist, Murray–Darling Freshwater Research Centre **d.nielsen@latrobe.edu.au** or on (02) 6024 9650

POTENTIAL RESEARCH TOPICS (HONOURS AND PHD)

Water Quality and Biogeochemistry

Project WQ1: The link between dissolved organic carbon (DOC) characteristics and algal blooms.

Harmful algal blooms (HABs) cost the global economy billions of dollars annually and are a major concern to human health, the health of the environment and the economy. Our understanding of what triggers such blooms and their associated toxicity is limited. Recently the formation of harmful algal blooms was linked to increased inputs of organic carbon (DOC) into waterways. DOC may also be utilised by some species of harmful algal species as a direct food source, stimulating growth and leading to the proliferation of these algae. Direct effects are likely to be related to the type of DOC present with differences in the bioavailability of terrestrially derived, highly aromatic DOC of a high molecular weight compared with autochthonous derived DOC, less aromatic and of a lower molecular weight likely. Our current understanding of the role of DOC in bloom formation is currently lacking. This is of great concern given that DOC concentrations and quality within freshwaters have been predicted to change in the future due to climate change and HAB are increasing in prevalence. Therefore, this project proposes to explore the role of DOC in harmful algal bloom formation and toxicity within the Murray Darling Basin by conducting both field and laboratory trials.

Contact: Aleicia Holland **A.Holland2@latrobe.edu.au**

Project WQ2: Hydrology and DOC in alpine peatlands during extreme events.

Alpine and sub-alpine peatlands are the source of many headwater streams in the Australian Alps, and likely have an important role in controlling the chemical composition of these streams. Our previous work has shown that peatlands strongly regulate (buffer) stream composition under storm flow conditions, with the major perturbation being the export of a dissolved organic carbon (DOC) ‘pulse’. This DOC pulse is likely important in the provisioning of energy for downstream processes, and also the delivery of chemical cues for stream biota. This project will combine a hydrology and chemistry to understand the relative contributions of rain water, groundwater and peatland storage water in the storm pulse (using isotopic tracers) and the characteristics of the DOC exported. In particular we are interested in understanding the biogeochemical processes that occur within the peat profile, and the mobilisation of organic molecules with changes in peatland water table. As part of this work we will look at closely spaced storm events and how this affects the characteristics of DOC exported. Climate change predictions for the Australian Alps are for more frequent and intense storm events; this work will provide invaluable information about the likely impacts of climate change on stream composition. [Note: this project involves working in alpine environments under challenging conditions]

Contact: Ewen Silvester **E.Silvester@latrobe.edu.au**

Project WQ3: Environmental controls on nitrogen cycling in alpine headwater streams.

Headwater streams in alpine environments are a major source of nitrogen to lowland rivers, lakes and wetlands, and likely have an important role in maintaining water quality in these environments. The forms (speciation) and concentrations of nitrogen in stream waters are largely controlled by assimilation or transformation processes mediated by microorganisms. While the fundamental nutrient transformation pathways are well understood, there is very little understanding of environmental drivers and the links to the microbiological communities. This is particularly the case for alpine streams in Australia where virtually no research has been conducted on microbiological N–transformation processes. This project will use metagenomic approaches to examine the community structure of the nitrifying organisms in the sediments of alpine streams and associated peatlands. We will measure a wide range of sediment and water quality variables at the same sites, and using multivariate statistical approaches, determine which variables play a major role in structuring the microbial communities. These results will also allow us to start predicting the role of catchment-scale process in driving microbial structure and function in streams, and the effects on exported nitrogen.

Contact: Gavin Rees **Gavin.Rees@latrobe.edu.au**

Fish

Project F1: What do Australian fish get out of accessing floodplain habitats?

A critical question in Australian river management—and indeed river management around the world—is: how does allocating water to floodplains affect the mean fitness of aquatic animal populations? Dominant theoretical frameworks of freshwater science contend that many fishes of river–floodplain ecosystems have evolved dependencies on floodplain access, but anecdotal evidence indicates that there is much uncertainty concerning the role floodplain habitats play in the population dynamics of freshwater fishes. The MDFRC is offering a PhD project focused on deciphering the significance of floodplain habitats to fish populations of the Murray–Darling Basin. This project will involve melding field and laboratory studies to compare and contrast the relative effects of floodplain and channel habitats on individual- and population–level fitness.

Contact: Rick Stoffels **R.Stoffels@latrobe.edu.au**

Project F2: Can we predict how floodplain fish communities will respond to flooding using functional traits?

Aquatic habitats on floodplains comprise a complex, dynamic network. The flooding regime drives an ever–changing sequence of floodplain habitat states defined by such things as the degree of connectivity among wetlands and wetland water quality (water temperature, dissolved oxygen levels, etc.). The overarching aim of this PhD project would be to determine whether we can predict how flooding regime affects habitat properties and, in turn, fish community composition. Broadly, the project would have three key components: (1) extensive logging and modelling of how hydrology, climate (rainfall and air temperature) and geomorphology (wetland morphometry) affect water temperature and dissolved oxygen dynamics of aquatic habitats; (2) laboratory experiments to estimate the parameters of models that describe how fish performance is affected by water quality; (3) predictions of how flooding regime and climate might affect fish community composition on floodplains.

Contact: Rick Stoffels **R.Stoffels@latrobe.edu.au**

Project F3: Floods, chemical cues and fish movement.

Research at the MDFRC has shown that the magnitude of lateral movements by river–floodplain fishes may be greater during natural connection events than during managed ones (e.g. opening of a regulator). Similar differential responses by fish to natural and managed floods have been reported in the northern MDB by Queensland Fisheries. The causal mechanisms underlying the responses to natural versus managed flooding are not understood, but may be due to managed flows not delivering appropriate chemical cues that activate fish movement onto the floodplain. This project will involve field and laboratory experiments that examine various types of flooding events (natural/artificial) and how these floods affect the quality and quantity of potential cues for fish movement. This is the first project in a research theme that tackles potential mechanisms that may differentiate fish response to natural versus managed flows and would comprise an interesting mix of fish ecology and environmental chemistry. The final design of the project will be developed strongly in conjunction with a successful candidate.

Contact: Gavin Rees **Gavin.Rees@latrobe.edu.au**

Project F4: Quantifying productivity and fish growth rates across different habitats.

Many fish species have a short critical period after hatching when appropriate food densities must be available to allow survival. With increasing pressure on water–managers to use limited volumes of water wisely for the environment, environmental water is increasingly being used to manipulate water levels in channels and in wetlands to support fish recruitment. This project will investigate what habitats need to be inundated to maximise zooplankton production and associated productivity to support of fish-recruitment. This will quantify the relationship between flow and zooplankton emergence from channels, perennial wetlands and intermittent wetlands sediments. Without this information, river managers will be unable to ensure there is sufficient larval fish–food to support recruitment following spawning under differing environmental flows.

Contact: Nick Bond **N.Bond@latrobe.edu.au**

Wetlands and Floodplains

Project WF1: Modelling floodplain vegetation shifts in response to changing water regimes and climate change.

The diversity of floodplain vegetation is maintained by the mosaic of habitats created by variable water regimes. Under increasing pressure to reduce the amount of water available for the environment in conjunction with climate change, the types of habitats available are is likely to shift. The aim of this PhD project will be to investigate and model the potential shifts in habitats for floodplain vegetation and associated changes in vegetation.

Contact: Susan Gehrig **S.Gehrig@latrobe.edu.au**

Project WF2: Ecology of rainfilled wetlands.

Although temporary, rain–filled wetlands are relatively common in many Mediterranean climatic regions of Europe, North America, Africa and Australia, most research in all these regions has focused on floodplain wetlands that derive water predominantly from rivers. Rainfilled wetlands are typically small (<10 hectare) and retain water for only short periods of time. Within the Murray–Darling Basin rainfilled wetlands are relatively common, but little is known about their ecology and their role in maintaining biodiversity within the landscape. These wetlands are threatened by changes in climate that result in increased frequency and duration of drought due to higher evaporation and decreased rainfall increasing the period in which they are dry. While the flora and fauna of many wetlands are adapted to variability, environmental degradation and long-term shifts in climate will pose a considerable risk to some biotic communities.

Contact: Daryl Nielsen **D.Nielsen@latrobe.edu.au**

Project WF3: Dormant eggs and/or seeds — Is dispersal effective in floodplain environments?

The ability of dormant seeds of plants and eggs of invertebrates to disperse is seen as important in maintaining diversity within riverine–floodplain networks. However, even though the potential for seeds and eggs to disperse is high, effective dispersal may below particularly in floodplain environments where dispersal may be impeded by the physical complexity of the surrounding habitat. This project test the hypothesis that for plants and invertebrates that rely on passive dispersal effective dispersal is low resulting in differences in communities between wetlands in close association to each other.

Contact: Daryl Nielsen **D.Nielsen@latrobe.edu.au**

Project WF4: Climate change impacts on the survivorship of dormant seeds and/or eggs.

The increase in temperature as predicted in the future climate studies will result in a change of timing, fitness and recruitment success. The reduction in recruitment success may result in a loss of dormant eggs and seeds as a result of temperatures exceeding a species thermal threshold result in changes in species assemblages, distributions and potential extinctions. This project will investigate the impact of changing soil temperature species assemblages

Contact: Daryl Nielsen **D.Nielsen@latrobe.edu.au**

Project WF5: Exploration of symbiotic interactions between River Redgums and mycorrhizal fungi on floodplains

Many plants rely on associations with other organisms, and mycorrhizal fungi associations are one common example. These associations are symbiotic relationships that promote the uptake of nutrients by the host plant, while in return fungi receive bioavailable carbon. Eucalyptus camaldulensis (River Redgum) is an iconic Australian tree that inhabits floodplains across Australia. The condition of River Redgum forests is important to floodplain managers, and environmental flows are delivered to floodplains to improve River Redgum health. While Eucalyptus spp. are known to form mycorrhizal associations, there is little detailed information specific to River Redgums – e.g. extent of mycorrhizal associations, how different flooding regimes might influence these associations or whether associations may differ with different tree life stages. This project will use a combination of field assessments, through to next generation DNA sequencing techniques to disentangle these questions. The overall project can incorporate Hons and PhD studies.

Contacts: Paul McInerney **P.McInerney@latrobe.edu.au**

Waterbirds

Project W1: Waterbird food requirements.

This activity seeks to improve our understanding of the food resources or energy required to support waterbird recruitment by undertaking investigations into the feeding frequency and energy requirements of colonial–nesting waterbirds. The data and model outputs will be used to inform managers how to use environmental water at their sites to maximise energy production for bird breeding success. This project will be linked to the Murray–Darling Basin Environmental Water Knowledge and Research project

Contact: Paul McInerney **P.McInerney@latrobe.edu.au**