THE UNIVERSITY OF ADELAIDE
AUSTRALIA

SUB CRUCE LUMEN

School of Earth and Environmental Sciences

Honours in
Ecology and Evolutionary Biology

2010

Information Booklet

General Information about a B.Sc. (Hons) degree

B.Sc (Honours) in the School of Earth and Environmental Sciences at the University of Adelaide is the gateway to increased job opportunities and to a great range of rewarding careers in research.

Our teaching and research staff are international leaders in their fields of science. Join us for your Honours project and you will be a member of a research team working at the leading edges of environmental, ecological and geological sciences. You will use state of the art facilities and train with world-class researchers in a contemporary learning environment.

Students who reach a sufficient standard of excellence in their undergraduate courses are eligible to apply for admission to this program. The Honours year consists of a major research project and a series of tutorials on various aspects of Science throughout the year. The research project is carried out either in a laboratory in the School or in a laboratory that is closely affiliated with the School (for example, in the NCPGG, CSIRO, SA Museum or SARDI). A list of Honours research projects is circulated during the second semester of each year. Following this, students who are considering Honours have an opportunity to discuss potential research projects with the academics who will supervise these projects.

What is Honours like?

As an Honours student you become a member of the School and a valued colleague. You will spend most of your time as part of a research group sharing goals, triumphs, disappointments and all of the other things that are part of the adventure of scientific research. For the first time, you become responsible for the outcome of your own scientific work. Honours students also partake in all aspects of the social life of the School. You will form friendships and professional associations that could last a lifetime.

The Honours degree gives students a thorough training in scientific method and a detailed insight into environmental and geological processes in the area of research that they pursue. The scientific approach to problem solving, maturity and self-discipline gained during the Honours year equips them for a wide variety of careers. Many of our students elect to continue in the research domain by enrolling in the School's PhD programs. However, the analytical and communication skills that our students acquire have led other Honours graduates into a range of different fields.

Contacts

For information about Honours in Ecology and Evolutionary Biology contact one of the Honours Coordinators:

Prof Roger Seymour, Room 103, Darling Building, ph (08) 8303 5596,
email: roger.seymour@adelaide.edu.au

Assoc. Prof José Facelli, Benham Building, ph (08) 83034559,
email: jose.facelli@adelaide.edu.au

For further information about Research Projects consult the staff member(s) whose interests are closest to your own or, if you are unsure, consult the Honours Coordinator.

Honours in Ecology and Evolutionary Biology

Introduction

As an undergraduate you have learned about many facts, ideas and resources, and you have demonstrated your facility at recalling, organising and interpreting that information. These are skills that you will call upon many times in future. So far, however, you may not have had many chances to develop and apply your own ideas. Here is one of the great attractions of the year ahead!

Honours is a very worthwhile supplement to your B.Sc. degree. It is not just a bridge to a postgraduate degree, nor simply a chance to explore an area of biology that especially interests you. It is also an opportunity for personal development: a test of your imagination, self-reliance and self-discipline. It will help to develop your confidence and prowess in clear thinking, criticism, communication and a variety of technical skills. These "advanced" skills are likely to enhance your prospects for employment in many areas, quite apart from biology.

Honours Ecology and Evolutionary Biology is the recommended option for the student who is enthusiastic about a career in research and academic pursuits within Animal and Plant Sciences from ecology, evolutionary biology, behaviour, and physiology, to the conservation and management of wildlife. An Honours degree is the usual stepping-stone to a higher degree but all possibilities for future employment remain open to you and are improved with an honours degree. Entry qualifications are normally credits in 9 points of third level Ecology and Evolutionary Biology subjects, or equivalent. Students from outside the University and from allied departments within the university may have equivalent courses and are encouraged to apply. Honours Ecology and Evolutionary Biology will run from early February until November. It is also possible to begin in second semester, and the course will run from late July/early August to May. Under exceptional circumstances, the Honours degree can be done on a half-time basis, over two years. For further information, contact the Honours Coordinator.

Honours is not an easy year. You will need to commit yourself to a series of challenging, sometimes arduous assignments, and you will be responsible for most decision-making and management of your time. This webpage should help you to decide whether you want to accept the challenge. It tells you about the content of the Honours program and offers suggestions about the various options, particularly the research project. If you need more information than is provided here, please see the Honours Coordinator.

Toward a higher degree

The Discipline of Ecology and Evolutionary Biology has had Honours classes of over thirty. Over the past several years, the number of students achieving a first class Honours degree has been about 50%, the Science Faculty average. Until recently, a first class degree virtually guaranteed a scholarship for postgraduate work toward a Ph.D. But times are getting tough and many first class Honours students were not offered scholarships in the first round in the last couple of years. Some Faculty Scholarships have been offered if the supervisor contributes 50% from their grants.

Honours students graduating without a scholarship are often able to pursue higher degrees if they are able to obtain a supervisor and discipline approval, and they are able to support themselves. Some financial assistance can be obtained through demonstrating in undergraduate courses, but this is not sufficient to be self-supporting.

Part-time higher degrees are also a possibility, but conflicting demands often make this course very long and lead to a less satisfactory result.

Course components

There are two main components in Honours Ecology and Evolutionary Biology:

Major Project (75 %) = about 22 weeks full time research project including an initial literature review, a research proposal and two short seminars, one at the commencement (unassessed) and a second which is presented after the written project is submitted. The project is submitted in the form of a Research Paper (hopefully with the intention of publication) with a substantially expanded discussion to cover relevant literature and to explore project issues more fully.

Broadening written components (25 %) which include a review article on a non-thesis-related topic (15 %) and a short essay on a topical subject (10 %).

In addition to the assessed tasks, students will also undertake an Occupation Health and Safety induction course and complete a Senior First Aid certificate, and should also attend regular or special seminars within the discipline and interact with the postgraduate students and staff. You should also become involved in some of the other activities that are part of University life, like assisting in an undergraduate camp, or accompanying an academic or postgraduate student in the field if you have the time. There will also be meetings between the class and the Honours Coordinator(s) and between individual students and their supervisor. Other meetings during the year will be devoted to discussions about the progress of your research, about ways to prepare essays, talks and posters, and the use of school resources (e.g. computer software and statistical methods).

Assessment

The Honours grading system is not like the one used for under-graduate courses. It ranges from First Class (I) through Second Class Division A (IIA), Second Class Division B (IIB) and Third Class (III), each with a numerical value. The greatest rewards in assessment are for originality, insight, clear thinking and technical competence. These things will come through hard work and dedication.

For the purpose of scholarship competition, all students will be ranked. The ranking within the classes is confidential. The top students will be known, however, because of prizes that are available in the Discipline.

Eligibility

To win a place in Honours Ecology and Evolutionary Biology you need: credits (65%) or better in three third - level Ecology and Evolutionary Biology subjects; and approval from a staff member with whom you have discussed a possible project, and who has indicated that they would be willing to act as your supervisor.

Both conditions can be varied in special circumstances, with permission from the Head of the Discipline and Honours Coordinator. If you are in any doubt over your eligibility, please ask the Honours Coordinator.

Some supervisors may not be able to accept you because there is a limit on the number they are allowed to supervise. You should investigate several alternative supervisors and projects.

If you come from another university, you may be eligible for Honours at Adelaide, depending on the courses you have taken and your results. Just contact the Honours Coordinator with your transcripts and scholastic desires and a decision by the Honours Acceptance Committee will be made. It helps to contact a potential supervisor first, but you can be accepted based on your experience and marks only.

How to apply

If you are interested in studying Honours in Ecology and Evolutionary Biology you need to contact a prospective supervisor to discuss potential honours projects and submit an Expression of Interest form to the Faculty of Sciences and await an offer of a place in the class. You are then free to accept or reject the offer; your application is not binding.

To find out how to submit your Expression of Interest and key dates go to the Faculty of Sciences Honours website at http://www.sciences.adelaide.edu.au/honours/.

For those intending to start in First Semester, the nominal deadline for applications is **6 November,** so that offers can be sent out in December. Later applications are possible, but there may be delays in processing. Those wanting to begin in Second Semester may apply in November, if they wish, or postpone their application until, at the latest, the end of May. If you are sure that you wish to make a mid-year start, you should apply in November, as potential supervisors may no longer be available by the May selection period. (Supervisors are limited in the number of students they can supervise). In some years certain kinds of projects are more popular than others, and it may not always be possible to give you your first choice of research project and supervisor. In case complications do arise, we ask you to nominate a reserve choice.

Scholarships for Honours

Some staff have research grants that may include a scholarship for a project that falls within the grant's umbrella. Talk to potential supervisors about this. Note there are a few 6-8 week summer scholarships available for the period before honours. In

general students should consult the web-site:
http://www.adelaide.edu.au/scholarships/honours/
or call the Scholarship Section on 8303 5271 regarding honours scholarships.

Research supervisors

Most Ecology and Evolutionary Biology staff should be available as supervisors, but some may be unavailable, either because they have their quota of students or they are on leave for part of the year. In addition, some of the staff employed at the Adelaide Zoo, South Australian Museum, State Herbarium, Dept of Environment & Heritage, and SARDI (Aquatic Sciences) are affiliated with the School of Earth & Environmental Sciences, and can offer projects act as supervisors. Some of these external supervisors are included below in the list of potential supervisors. Other external supervisors are possible but may need to work with an EB staff member as an "internal" supervisor. If you have ideas in this direction, discuss them with the appropriate staff member or the Honours Coordinator.

Role of the supervisor

Your research supervisor is someone with enough expertise in your field of interest to be able to advise you about techniques, literature and so on. S/he should not direct your research, but offers support, counsel and criticism, particularly in the planning stages. In consultation with your supervisor, you need to refine the original idea (which may be only vaguely defined) and develop a work plan. It may be a month before you have a clear set of goals. In this process you are expected to play the major role: your supervisor will look to you for bright ideas and initiative.

Supervisors know from experience that student's inclinations and abilities differ, and they adjust their contribution accordingly. Of course, you may need to make comparable adjustments in the demands you make on your supervisor! Your relationship with your supervisor therefore is important. S/he should be someone you find easy to talk with and, most importantly, someone you feel you could work with and learn from.

Finally, it is your responsibility to maintain close contact with your supervisor and work out problems immediately when they arise. There will be problems, and they tend to get worse if not dealt with quickly.

Role of the Honours Coordinator

The Coordinator will want to keep in touch with the progress of each student and, in particular, to offer advice and support if needed. The Coordinator is there to direct the course as a whole, to oversee assessment of components, to organise and sit on all marking committees, and to assemble final reports so that the academic staff can decide on final marks and rankings.

Choosing a Research Project

Try to put aside the idea that now is the time to commit yourself to your future career. Honours provides an introduction to research, and there are many pragmatic considerations to over-ride what may be a long-held interest in tropical rainforest, dingoes, crocodiles, whales or other intriguing animals. Even if a competent supervisor is available, some project ideas will be judged as simply impractical for Honours. Your project need not be a commitment to the kind of work you want to do in future. Even so, you must have a genuine interest in it. If your enthusiasm is tentative, you may find it hard to weather bouts of drudgery or those occasions when your best-laid plans go wrong.

As a rough guide, the research project is equivalent to about 22 weeks of full-time work. As your time is limited, your project should be a modest one. It is much wiser to "take a small bite and chew it well" than to be over-ambitious.

Your budget also is limited. The Discipline allots a modest sum of money to your supervisor to support your research. However, if your project involves extensive travel you will run down your budget very quickly, unless you are able to offset the costs personally or by arranging shared field trips. Your supervisor or the administrative staff can help you with cost estimates.

Your project should be foolproof. That is, it should have a straightforward core that will guarantee you some results even if all your experiments fail. By all means be adventurous, but insure yourself against disappointments. If the subject of your study is a population of animals, it should be abundant, easily accessible and, if necessary, easily maintained in the lab. It is better to work with houseflies than platypuses. Avoid projects that depend on seasonally available animals or plants.

Your project should have some scope for your ingenuity. A simple survey is likely to produce a rather drab, uninteresting thesis, unless some form of critical inquiry accompanies it. One way to develop this part of your project is to design experiments to explore what you see as the critical questions. They may not work, through no fault of yours, but you are unlikely to be penalised if you understand clearly what went wrong and what might be done in future. Your examiners will be interested in your reaction to whatever difficulties may arise; endeavour to learn from your mistakes and turn them to your advantage. Some of our most highly regarded theses contain few original results; their winning virtues are more in the realm of "good ideas".

One way to think about a topic is to look beyond your project to a prospective publication in a scientific journal. If you are planning to go on to a higher degree, a publication based on your Honours research is a fine way to launch your career!

In short, choose a reasonably simple project that you would find interesting, and one "safe" enough to guarantee some results and yet provide scope for innovation and experiment. Your work can be hypothesis-oriented or descriptive, or both. Sometimes a project can begin with a relatively "safe" core of descriptive material. As the work is carried out, unforseen questions arise and hypotheses can be tested.

Supervisors and projects

The research interests of potential supervisors within the Discipline of Ecology and Evolutionary Biology are provided below with a few suggested projects. Bear in mind that these are suggestions only. They give an idea of the research areas of potential supervisors and what they are interested in at the moment. The supervisors also think that they are feasible. However, all staff will be pleased to discuss your own ideas and determine their feasibility.

If you are interested in any of these suggestions, or if you would like to discuss variations related to the staff member's research interests, make an appointment to talk with them. If you are from interstate, please contact the appropriate staff member(s) by email or telephone.

Potential supervisors and their general research interests

Potential Supervisor	Research interests	Availability
Prof. Andy Austin	Systematic, phylogenetics and evolution, of insects and other arthropods	2009; 2009-2010
Dr Jeremy Austin	Conservation genetics, molecular ecology and ancient DNA	2009; 2009-2010
Prof. Barry Brook	Ecological & biodiversity impacts of climate change	2009; 2009-2010
Assoc. Prof. Justin Brookes	Aquatic ecology; trophodynamics	2009; 2009-2010
Assoc. Prof. Sue Carthew	Mammal ecology; pollination biology; conservation biology	2009; 2009-2010
Assoc. Prof. Sean Connell	Marine ecology	2009; 2009-2010
Dr John Conran	Plant systematics and evolutionary ecology	2009; 2009-2010
Prof. Alan Cooper	Evolutionary patterns and ancient DNA	2009; 2009-2010
Dr Steve Cooper	Phylogeography; speciation; molecular ecology;	2009; 2009-2010
Assoc. Prof. Jose Facelli	Terrestrial plant ecology	2009; 2009-2010
Assoc. Prof. George Ganf	Ecology of phytoplankton & aquatic plants	2009; 2009-2010
Assoc. Prof. Bronwyn Gillanders	Aquatic ecology, especially estuaries, fish biology; otolith microchemistry	2009; 2009-2010
Prof. Bob Hill	Evolution of the Australian vegetation, plant macrofossils	2009; 2009-2010
Dr John Jennings	Insect evolution and systematics	2009; 2009-2010
Assoc. Prof. Bo Jin	Water management	2009; 2009-2010
Prof. Andy Lowe	Gene flow in plants	2009; 2009-2010
Assoc. Prof. David Paton	Ecology and behaviour of birds, plant-animal interactions; fire; restoration	2009; 2009-2010
Assoc. Prof. Fred Recknagel	Ecosystem modelling; freshwater ecology	2009; 2009-2010
Assoc. Prof. Rob Reid	Plant nutrition and ecotoxicology	2009; 2009-2010
Prof. Roger Seymour	Ecophysiology of animals and plants	2009; 2009-2010

Dr David Taggart	Marsupial life history, reproductive ecology, population biology, disease and conservation biology	2009; 2009-2010
Dr Jenny Watling	Ecophysiology of plants	
Dr Ian Whittington	Fish parasite interactions	2009; 2009-2010

Additional potential supervisors (as main or co-supervisors) for 2009 and or 2009-2010 include:

In Ecology and Evolutionary Biology:
Dr Barry Taylor, Dr Kane Aldridge; Dr Daniel Rogers; Dr Russ Shiel; Dr Scott Mills.

In the South Australian Museum:
Assoc Prof Mike Lee; Dr Mark Hutchinson.

In the Department of Environment and Heritage:
Dr Phil Ainsley; Dr Meredith Henderson; Dr Manfred Jusiatis.

In the South Australian Research and Development Institute, Aquatic Sciences:
Dr Anthony Fowler; Dr Simon Goldsworthy; Dr Mike Steer; Dr Jason Tanner; Dr Qifeng Ye.

Prof. Andy Austin **Evolution and Ecology of Invertebrates**
Dr Steve Cooper
Dr Michelle Guzik
Dr John Jennings
Darling Building andy.austin@adelaide.edu.au; cooper.steve@saugov.sa.gov.au; michelle.guzik@adelaide.edu.au john.jennings@adelaide.edu.au;

Arthropods are the most diverse and ubiquitous animals in terrestrial and freshwater environments. They are important targets for evolutionary and systematics research, as well as for examining biodiversity, ecosystem function, and as pests and beneficial species. Our research focuses on a number of key issues in contemporary biology, using an array of both morphological and molecular techniques. As a guide to the types of projects honours students might undertake, here are some specific examples:

1. Evolution and ecology of endemic groundwater spring invertebrates in the Great Artesian Basin

Supervisors: Prof Andy Austin and Dr Michelle Guzik (contact andy.austin@adelaide.edu.au)

The mound springs represent one of Australia's most significant environments and their conservation is a national priority. Despite being surrounded by desert, these springs are home to a diverse array of unique aquatic invertebrates. However, there is a lack of knowledge about the evolution and ecology of spring communities and specific organisms. Preliminary work has uncovered significant cryptic diversity in

the aquatic species of these springs, which leads to a number of interesting project possibilities in two general areas; working mainly on spring crustaceans, insects or molluscs.

A) The evolution of spring endemics;
- Where have spring organisms evolved from?
- Do all spring endemics show high levels of cryptic diversity?
- Are there common geographical patterns of diversity between distinct groups of organisms?
- Are there common patterns of diversity across geographical locations?
- Are there non-aquatic fauna endemic to the springs?

B) Ecology of springs and their fauna.
- Is there an ecological basis for cryptic diversity?
- Why are spring fauna confined to springs?
- Is there dispersal potential for spring fauna?
- Do springs represent a homogeneous environment?
- Are there non-aquatic fauna associated with springs?

Potential projects could involve one or more of the above questions, and are ideal for students interested in working on a unique biological system, with the potential for discovering new species and undertaking interesting fieldwork.

2. The systematics and evolution of insect parasitoids

Supervisors: Prof Andy Austin & Dr John Jennings (contact andy.austin@adelaide.edu.au)

Parasitic wasps are extremely diverse in most terrestrial ecosystems and are often used as biocontrol agents of insect pests. An international research program focussing on the sytematics of parasitic wasps is exploring their taxonomic diversity, phylogenetic relationships, and evolution of hosts associations. There are several possible honours projects that combine comparative morphological studies and molecular techniques to examine the systematics of specific groups.

3. Evolution and phylogeography of subterranean aquatic invertebrates

Supervisors: Dr Steve Cooper, Michelle Guzik and Prof Andy Austin (contact Cooper.Steve@saugov.sa.gov.au or andy.austin@adelaide.edu.au)

This project focuses on an extraordinary new ecosystem of subterranean aquatic animals (stygofauna) that were recently discovered in numerous isolated calcrete aquifers of central Western Australia. The entire system resembles a subterranean archipelago and each aquifer appears to have a unique suite of different species, including water beetles and a variety of different crustaceans. The water beetle fauna alone is the most diverse of its kind in the world with over 100 species known so far. Considerable research is still required to document the diversity and understand the evolutionary history of this fauna, information that is crucial for the sustainable management of these ecosystems.

4. The evolution and biology of insects associated with galls.

Supervisors: Prof Andy Austin, Dr John Jennings & Dr Gary Taylor (contact andy.austin@adelaide.edu.au or john.jennings@adelaide.edu.au)

Plant galls that are initiated by specific groups of insects provide food and shelter for other insects including herbivores, predators, inquilines and parasitoids. These communities are usually highly diverse, and coevolved in that the members utilising the gall are often dependent on each other in either beneficial or antagonistic ways. The Myrtaceae in Australia harbour many gall-forming insects, and these systems provide ideal models for research in the systematics of co-dependent groups, the evolution of insect-plant-parasitoid tritrophic interactions. An honours project in this area would inevitably include both extensive field work and laboratory-based research.

5. Phenology of *Allocasuarina verticillata* and diversity of the associated insect fauna.

Supervisors: Dr Gary Taylor, Dr John Jennings and Prof. Andy Austin (contact john.jennings@adelaide.edu.au or andy.austin@adelaide.edu.au)

Although there are several *Allocasuarina* species on Fleurieu Peninsula, the dioecious *A. verticillata* is widespread and the insect fauna associated with it is diverse, ranging from scale and lerp insects (Hemiptera) to various moths and beetles. The insect fauna seems to vary with sex of the host tree and whether the females are flowering or fruiting, or the males are producing pollen. One of the potential projects will be to investigate the phenology of *A. verticillata* and the associated insect fauna. This project will involve extensive field work and is suitable for a mid-year intake.

Dr Jeremy Austin	**Molecular Ecology and Ancient DNA**
Darling Building 209a	jeremy.austin@adelaide.edu.au

My research focuses on using molecular, DNA-based, "tools" to understand how past environmental change has affected population divergence and speciation in vertebrates (phylogeography), how recent anthropogenic changes have affected species that have declined (conservation genetics) and to provide evidence for wildlife forensics.

Two projects are currently available:

1. Conservation genetics of wedge-tailed eagles.

The wedge-tailed eagle (*Aquila audax*) is the largest raptor in Australia and one of the largest birds of prey in the world. The Tasmanian subspecies, *Aquila audax fleayi*, is currently endangered (Commonwealth EPBC 1999, Tasmanian TSPA 1995).There is an urgent need for genetic assessment and long-term monitoring of wedge-tailed eagle populations to complement existing management and monitoring programs. This project will use non-invasively collected feather samples from eagles across mainland Australia and Tasmania to investigate broad-scale population structure.

2. Phylogeography of rainforest birds of eastern Australia.

Australia's tropical and sub-tropical rainforests are confined to a small number of areas on the east coast. The three most important being the Wet Tropics, mideast Queensland and south east Queensland. Vertebrates confined to these rainforest blocks are isolated from each other by large tracts of unsuitable habitat, providing opportunities for genetic divergence in isolation. Previous work using mitochondrial DNA sequences has revealed a complex relationship in species that span each of these rainforest blocks. This project will use nuclear intron DNA sequences to further investigate the evolutionary history of a number of species of rainforest restricted birds. The project will involve laboratory work on existing DNA samples with the possibility of one field trip to the Brisbane area to collect more samples.

Prof. Barry Brook	**Ecological & biodiversity impacts of climate change**
Mawson Building	barry.brook@adelaide.edu.au

It is widely acknowledged that the planet has warmed over the past century and that much of the observed warming has been due to increases in atmospheric greenhouse gases. Regardless of our efforts to reduce emissions within the next few decades some level of climate change is now thought inevitable and will require adaptation. Prof Brook's research concerns the impact of climate change (past, present and future) on natural systems and the interaction of different drivers of human threat. Likely future impacts are modelled at a global, regional and a local scale, to provide a robust scientific underpinning for scientific management and Government policy.

Prof. Brook is Director of the Research Institute for Climate Change and Sustainability (RIsCCS), a joint initiative of the University of Adelaide and the South Australian Government, with the goal of undertaking research to mitigate carbon emissions and develop adaptive strategies to respond to the anticipated impacts of climate change. Information about RIsCCS: http://www.adelaide.edu.au/climatechange

Projects

Linking population viability models to bioclimatic projections: Develop bioclimatic projections for a range of well-studied species and compare these projections of geographic range shifts to those generated via population viability assessments.

Developing generalisations for inferring extinction risk: Use generalised linear modelling and Bayesian analysis to develop an approximation to complex population viability analysis simulations. This has the potential to greatly improve inference of extinction risk in threatened species with limited demographic and life history data.

The impact of life-history traits on royal penguin population dynamics: Analyse a 17 year capture-mark-recapture data set and notebook archive of royal penguins on Macquarie Island (covering the historical window of 1956-1972). The aim is to quantify changes in demographic rates and population trends in response to early recent climate change and the impact of introduced rabbits and cats.

Other projects include:

- Climate change impacts on Adelaide's biodiversity (e.g., analysis of DEH biosurvey data, computational modelling of landscape and community change)
- Development of numerical simulation models for wildlife management and conservation recovery programmes
- Statistical/simulation modelling of long-term time series databases
- Development and validation of models of extinction risk

For information on previous work by Professor Brook and collaborators in these areas, and for further ideas on possible projects based on his previous research, see: http://www.adelaide.edu.au/directory/barry.brook

The development of tailored research projects, which match the students specific interests, would be welcome. All projects are well-supported logistically (most involve the analysis of extensive and carefully prepared datasets) and scholarships of $1000 are available for candidates with particularly strong academic records.

Assoc. Prof. Sue Carthew	**Mammal ecology; pollination biology; conservation biology**
Dr Melanie Lancaster	
Dr Steve Cooper	
Benham Building	**sue.carthew@adelaide.edu.au**

Research in our group focuses on various aspects of mammalian ecology and socio-biology (mating systems, social organisation), often with strong conservation and management outcomes. Two Honours projects will be available in 2008-09.

1. Conservation genetics of the Southern Brown Bandicoot in fragmented landscapes
Supervisors: Assoc. Prof. Sue Carthew, Dr Melanie Lancaster and Dr Steve Cooper (SA Museum).

This project is based in the 'Green Triangle' region of south-east South Australia, one of Australia's main softwood plantation regions. Native forests in the region have been severely fragmented and suitable habitat for terrestrial marsupials consists of remnant patches of vegetation isolated by pine plantations or pastoral land. Habitat fragmentation poses a serious threat to biodiversity by restricting movement and gene flow among patches, which can lead to inbreeding and local extinctions. It may also have profound effects on the mating systems and social organisation of species. The aim of this project is to explore the population structure of the nationally endangered Southern Brown Bandicoot within remnant patches of native forest and in doing so, assess the effects of habitat fragmentation on this species. It will involved both field and laboratory work. Although some tissue samples have been previously collected, field work to obtain samples from additional bandicoots will be undertaken by the student. Genetic markers (microsatellites) will then be used to explore gene flow and dispersal of bandicoots among patches, and the ability of the species to move through hostile landscapes. This project will provide the student with valuable skills in population genetic techniques that can be applied to a broad range of fields, and will have direct implications for the management of this species in Australia.

2. Reintroduction of the tammar wallaby in South Australia

The tammar wallaby (*Macropus eugenii eugenii*) originally inhabited much of southern SA, including the Yorke Peninsula. A combination of habitat loss, predation by introduced species and hunting drove it to extinction by the late 1920's. Fortuitously, a population of the mainland sub-species was introduced to an island off New Zealand, in the 1860's, providing an opportunity for its reintroduction to mainland Australia. A total of 85 animals were brought back to Australia several years ago, and these animals have been involved in a captive breeding and reintroduction program, jointly conducted by the Department for Environment and Heritage, University of Adelaide, Adelaide Zoo and Monarto Zoological Park. Three releases into Innes National Park have occurred to date, with another planned for spring 2008. You have an opportunity to be part of the research program monitoring the success of this and previous releases. This will involve radiotracking and regular trapping of released animals, and interrogation of trapping data collected throughout the project. Information obtained will be used to assess how animals establish and guide future releases into other areas.

Assoc. Prof. Sean D. Connell	**Marine ecology**
Darling Building	sean.connell@adelaide.edu.au

1. Climate Change.

There is an urgent need to redress ignorance (and skills shortages) on the effects and mitigation of climate change. This project subjects key marine ecosystems to manipulations of ocean conditions that match those forecasted in 50 and 100 years time. This includes the effects of rising CO_2, ocean acidification, temperature and their effects on switching ecosystem function. There has never been a more pressing research topic in marine biology.

2. Changing coastal biodiversity: integrating state policy & policy makers.

Some government institutions are unaware, or unwilling to acknowledge, the consequences of their managerial decisions on declining coastal biodiversity. This project uses South Australian state policy and policy makers to design a project to provide explicit information of the current and future consequences of current governance on coastal biodiversity. You will meet and learn about the institutional mandates and needs, strengths and weaknesses of state NRM Boards, EPA and DEH.

3. Redressing a skills shortage in coastal marine ecosystems.

Australia has a skills shortage in the analysis of seawater for nutrients and expertise on how to avoid ecosystem collapse. This project will train you in an area needed by future state government initiatives (witness $9.8 Million to be spent on South Australian marine biology to underpin state capacity in marine biology & aquaculture).

Other projects include: Antarctic ecology, fish ecology, plankton ecology, coastal vegetation and change, catchment management, habitat restoration.

Dr John Conran	**Evolution and ecology of the Australian flora**
Benham Building 109	john.conran@adelaide.edu.au

My research looks at the molecular and morphological evolution, reproductive biology and community ecology of Australasian seed plants and weeds. This involves studies of character evolution and biogeography in Australian plants, especially the Lilianae (petaloid monocotyledons), carnivorous plants (especially Byblidaceae, Cephalotaceae, Droseraceae and *Utricularia*), Malvaceae and Podocarpaceae (southern conifers), in response to changes in climate throughout their evolution. The work involves the use of both classical and molecular approaches and involves families that, although of worldwide distribution, have both major centres of diversity in Australia, endemic, primitive members mainly confined to the rainforests of E Australia. The research explores the relationships of these often highly isolated ancient groups, and the ecological processes which led to their diversification with the spread of arid and nutrient-poor regions, as well as the biology of weeds as they invade and adapt to conditions here.

There are several suggested projects below, although I am happy to consider other topics of interest to students in the areas of plant systematics, weed biology and reproductive ecology.

1. Biology and ecology of the weedy shrub *Euryops abrotanifolius* in the Adelaide Hills. The new freeway cutting above the Heysen Tunnel has revealed the presence of a large colony of this plant, which appears to be spreading into the surrounding bush. As its native habitat in S Africa is climatically similar to the Adelaide region, the potential for this taxon to spread and its reproductive biology need to be studied so that it can be managed before it becomes one of the 'next major weeds' in the Adelaide region.

2. Biology and ecology of the weedy shrub *Argyranthemum frutescens* in the Fort Glanville reserve, Semaphore. The remnant sand dunes at Semaphore have been severely degraded though human impact and weed invasion, but whereas the Tennyson Dunes are the focus of major recovery work (with varying success), the area around Fort Glanville is under major threat from the Marguerite Daisy, which is now one of the dominant shrubs in the reserve. Given that almost no dune systems now survive on the Adelaide foreshore, the biology of this plant and its control are important if this remnant is to have any long term chance of recovery and persistence.

3. Aspects of morphological diversity and evolution in Australian *Utricularia* spp. (several possible projects) The carnivorous plant genus *Utricularia* (Lentibulariaceae) has a major centre of diversity in northern Australia, but the Australian taxa are little if at all studied in recent investigations of evolution within the family. As seed, trap, floral, gland and ovary characteristics are important taxonomically within the family, an investigation of some of these features from a systematic viewpoint may help to establish the relationships of the more unusual members of the genus, as well as help place the large number of new species being discovered in the region. Similarly, there are a number of species complexes requiring study so that the taxa within them may be conserved more effectively once the exact number of taxa is known and their distributions understood. This work would be done in collaboration with the NT and WA herbariums and their extensive collections.

Prof. Alan Cooper	**Evolutionary processes and ancient DNA**
Darling Building	alan.cooper@adelaide.edu.au

The Australian Centre for Ancient DNA (ACAD), located in the Botanic Gardens, uses genetic records from preserved animal, plant and environmental material to study evolutionary processes, especially the impact of environmental change and human alteration of environments. The emphasis is on phylogenetic and population genetic studies of animal populations, particularly with specimens distributed over a range of time periods. The approach is to integrate ancient sequence information with modern data to analyse a variety of evolutionary and environmental processes - including the validity of common assumptions used in phylogenetic and phylogeographic analyses. Current research at ACAD focuses on the evolutionary relationships of extinct species, megafaunal extinctions, speciation processes, human evolution and also the theory and application of molecular clocks.

A variety of laboratory projects is available, but particularly strong molecular biology skills are needed due to the complexity of ancient DNA work. Theoretical evolution projects are also available, involving a variety of bioinformatics and computational methods, and these require a strong analytical and computer-based background. More information is available at www.adelaide.edu.au/ACAD

Assoc. Prof. José M. Facelli	**Terrestrial plant ecology**
Benham Building	jose.facelli@adelaide.edu.au

The research within the Laboratory of Terrestrial Plant Ecology focuses its research in water-limited ecosystems, using an approach that always includes a strong conceptual component and rigorous experimental design and statistical analyses.

Currently there are projects available in the following research areas:

1. The sources and consequences of spatial and temporal variability in chenopod shrublands.
Spatial and temporal variability is a key aspect of the structure and function of arid land ecosystems. During the last 12 years we have investigated how some of this heterogeneity is generated (e.g. by accumulation of nutrients around perennial plants, through the effect of grazing animals, etc.). We have also investigated the role of heterogeneity on population dynamics, community structure and ecosystem processes). Some of our research in this area has direct practical implications for the management of rangelands, while other aspects of the research are more directly linked to the development of current ecological theory, in particular through the testing of the Storage Effect Model of species coexistence. There are opportunities for research on the interactions between annual plants and shrubs, assessment of heterogeneity in distribution of seeds in the soil seed bank, and aspects of the competitive effects between shrubs. NOTE: Because of the seasonality of the system most project are available only for the beginning-of-the-year intake. The research is based at the Middleback Field Centre, near Whyalla.

2. The ecology of invasive plants in native ecosystems.
One of the main threats to the biodiversity of Australia is the introduction of invasive plants in native ecosystem. The study of the strategies that make some of these species successful and the effect they have on native species and ecosystem function is central to devising strategies for the control of invasive species. A wide range of projects are available in this area, ranging from the interactions between a native parasitic plant (*Cassytha pubescence*) and introduced legumes, to the effects of invasive species on soil microbial processes. Most these projects can be conducted within a short drive distance from the North Terrace Campus.

3. Interactions between microbes and plants
The research in this area includes the effects of mycorrhizal associations on seedling establishment and plant competition, plant-soil-microbe feedbacks, and the effects of pathogens on native vegetation. We are particularly interested in *Phytophthora cinnamomi*, a soil-borne plant pathogen that causes dieback of a wide range of Australian native plants. We are studying the degree of susceptibility of threatened and ecologically important species in the vegetation of the Flerieu Peninsula.
Most of the projects in the area would include co-supervision with experts in the biology of the microorganisms of interest.

LIMNOLOGY
CLEAR Water Research Group – Catchments, Lakes, Estuaries and Rivers

Assoc Prof George Ganf	**Phytoplankton & Macrophyte Ecology**
Assoc Prof Justin Brookes	**Cyanobacteria, The River Murray**
Dr Kane Aldridge	**Biogeochemistry, Lake processes**
Dr Brian Deegan	**Aquatic plants, River restoration Foodwebs**
Dr Lionel Ho	**Water Treatment, Biodegradation**
Assoc. Prof Mike Burch	**Cyanobacteria, Water Resource Management**
	***Cryptosporidium* survival, microbial ecology**
Benham Building	george.ganf@adelaide.edu.au
	justin.brookes@adelaide.edu.au

The Limnology group within the discipline of Ecology and Evolutionary Biology currently has research projects that focus on the Coorong, the upper Southeast, the Murray River and the Great Australian Bight. In addition we have an interest in tropical rivers of the Northern Territory, South Australian Aboriginal Lands, the Torrens and other creeks and rivers of the Mt Lofty Ranges. Our approach is experimental rather than descriptive and relies upon field observations that can be tested either in the laboratory or by manipulation in the field. The group focuses on aspects of biogeochemistry, phytoplankton and macrophyte ecology, productivity and physiology as well as the transfer of material from one trophic level to another. Environmental flows, water allocation, and wetland / creek / river rehabilitation are practical outcomes that arise from this research.

The group also has a strong interest in providing solutions to the water industry. This includes reservoir management, using sophisticated sensors for detecting hazards and treatment solutions for chemical and biological contaminants.

The group collaborates internationally and we are involved in:

- The Global Lake Ecosystem Observation Network (GLEON)
- The Global Water Research Coalition,
- The CRC for Water Quality and Treatment
- The Adelaide University Water Cluster
- The Australia-China Environmental Science and Technology Institute
- Research Institute on Climate Change and Sustainability

We have ongoing projects with Germany, China, Brazil, USA, France, New Zealand and Taiwan.

Students interested in any of these areas should contact the George Ganf or Justin Brookes. A mid-year start would appropriate for some projects because biological activity is curtailed during the winter months. Graduates with skills in water resources will have good job prospects in the future as the community tries to balance water demands and limited water resources

Projects are not limited to those listed below and we welcome discussion on other ideas and projects.

1. The influence of water level drawdown on nutrient dynamics of the Lower Murray Lakes

Due to current drought conditions, the Lower Lakes of the Murray River system are experiencing a rapid drop in water levels. This is likely to cause large areas of sediment to become dry, with reflooding resulting in nutrient release from the sediments. In addition, finer sediment, currently in deeper parts of the Lakes are likely to be exposed to wave action and suspended into the water column, thus enhancing nutrient release into the water column. The aim of this project is to examine the extent to which these two mechanisms are likely to influence nutrient levels in the lakes and assess the increased potential of the occurrence cyanobacterial blooms.

2. The influence of lake drawdown and subsequent macrophyte die-back on nutrient fluxes in the Lower Murray Lakes

Due to current drought conditions, the Lower Lakes of the Murray River system are experiencing a rapid drop in water levels and increasing in salinity which is likely to cause a significant loss of macrophytes within the lakes. The aim of this project is to; identify the important mechanisms for nutrient release; determine the extent that macrophyte die-back will influence nutrient levels in the Lower Lakes; and assess the increased potential of the occurrence cyanobacterial blooms.

3. *Ruppia* and the biogeochemistry of the Coorong; untangling the cause and effect

Ruppia spp form an important component of inland water ecosystems. Indeed, in the Coorong *Ruppia* was once abundant has been identified as a key species for the functioning of this ecosystem. The loss of *Ruppia* from the system has coincided with an altered biogeochemistry. It is likely that the biogeochemistry of the system influence the presence of abundance of *Ruppia*, but also likely that *Ruppia* influences the biogeochemistry of the system, thus altering the potential habitat available for

other biota. The aim of this study is to determine whether the decline in *Ruppia* is a result of, or cause of the altered biogeochemistry of the Coorong. A similar study could focus the ability of emergent and submerged plants to tolerate hyper-salinity, sulphide toxicity and hypoxia.

4. The influence reduced river inputs on nutrient balances of freshwater systems

Reduced input of water from rivers into lakes is a common occurrence around the world, which reduces the amount and form of nutrients entering river and lake systems from the terrestrial landscape. These reduced inputs also increase water residence time in lakes, thus increasing deposition of inorganic and organic material. This results in release of nutrients from the sediment, essentially switching the primary source of nutrients from external inputs to internal inputs (sediments). This is likely to alter the form of nutrients within the water column, which will have major implications for the biota of the system through altered ecological stoichiometry. The aim of this study is compare the relative abundances of various forms of nutrients entering lakes from external and internal inputs.

5. Development of an index for aquatic plant condition

Aquatic plant communities are exposed to a wide range of anthropogenic stresses. Currently there is no tool available for managers to be able to assess the condition of individual plants efficiently and effectively. This project will investigate a wide range of measurements of plant condition (structural and physiological) and their responses to various perturbations. The aim of this project is to development an index that is available to manager to quickly assess the condition of individual aquatic plants.

6. Functional and structural algal community responses to perturbations

Algal communities are highly dynamic and able to respond quickly to perturbations. Unlike less dynamic communities (macrophytes) their community composition is likely to change in response to perturbations with little apparent change in the functioning of the community. This makes it extremely difficult to assess the condition of algal communities without carrying out time-consuming identification and counts. The aim of this project is to compare the functional and structural responses of algal communities to perturbations in order to determine appropriate measurements for assessing the condition of algal communities.

7. Organic carbon accumulation in shallow coastal lagoon

Coastal lagoons in the South-East of South Australia are hyper-accumulating dissolved organic carbon. This indicates that the ecosystem metabolism is out of balance. The reasons for this could be excessive phytoplankton growth, salinity or nutrient limitation constraints on bacterial mediated carbon degradation. The lake is in a highly degraded state and restoration will require understanding of lake metabolism so that effective solutions can be implemented.

Dr Bronwyn Gillanders **Dr Travis Elsdon** Darling Building	**Aquatic ecology and fish biology** **bronwyn.gillanders@adelaide.edu.au** **travis.elsdon@adelaide.edu.au**

My research focuses on aquatic ecology, with a strong emphasis on fish and fisheries ecology. One of our major gaps in knowledge concerns identifying origins (e.g. nursery habitats) and potential movements of organisms and determining past environmental histories. I am particularly interested in the use of chemical signatures (e.g. trace elements and isotopes) in ear bones to track movements. This interest is also being used to solve issues of sustainability of the giant Australian cuttlefish and freshwater fishes of the Murray River. Besides the three projects listed below I am also interested in supervising projects related to estuarine or reef fish.

Ear bones as indicators of past environmental histories

There are many options for projects within this research area – some of these projects may be co-supervised by either Andrew Munro or Travis Elsdon (both University of Adelaide)

Otoliths or ear bones are located within the inner ear of teleost fish. Their primary function is the detection of sound, but they have more recently been used to identify environments that fish have experienced via analysis of elemental composition. Although many field studies are analysing elements within the ear bones of fish, their ability to interpret such analyses is limited without a thorough understanding of the factors that affect the chemistry of the otoliths. There are a range of possible projects that involve raising fish or invertebrates under different experimental conditions and determining effects on trace elements and stable isotopes within the otoliths. In addition, there are other field-based projects that could for example, investigate movement of fish using differences in trace elements. Potential species for such work include estuarine/marine (e.g. mulloway, bridled goby) and freshwater (e.g. golden perch, Murray cod) fish, as well as cephalopods (e.g. squid) and gastropods.

Diadromy in South Australian fish

Diadromous species are important coastal and inland species, and comprise those species that move across salinity gradients as a routine part of their life history. Although life histories of fish typically involve movement among spawning, growth and refuge habitats, recent studies suggest that the life cycles of many species of fish have been oversimplified and that considerable variability may exist within and among species and populations. This project will use trace elements (Sr, Ba) and stable isotopes (Sr) of ear bones to determine movements of diadromous species and relate these movements to the age of the fish thereby providing unprecedented information on the timing and frequency of movement.

Fish in estuarine habitats

Many fish utilise a variety of habitats (e.g. seagrass, mangroves, saltmarsh) during the juvenile stages of their life cycle and then move to habitats that are some distance away. We currently have little information on which species use which habitats and how this may change with distance from different habitats. For example, does proximity to mangroves influence abundance of seagrass fish? There is scope for many projects in this area depending on the interest of the student.

Dr Frederico Gurgel	**Phycology (Algae), Taxonomy** **Molecular systematics** **Speciation in the marine environment**
Darling Building SA State Herbarium	fred.gurgel@adelaide.edu.au gurgel.fred@saugov.sa.gov.au

The South Australian (S.A.) State Herbarium, located in the Adelaide Botanical Gardens, carries out fundamental and applied research on plant systematics and evolutionary biology. Within the herbarium, the Phycological Unit conducts integrative research on the molecular systematics of marine benthic macroalgae (i.e., red, green & brown algae + seagrasses, a.k.a. seaweeds) at different levels of biological organization, to produce a more holistic picture of their biology and evolution. Our research involves the collaborative interactions of different business partners such as the University of Adelaide, the Department for Environment and Heritage and SARDI / Aquatic Sciences.

The S.A. coastline has one of the most diverse and unique marine flora in the world. The marine algae of S.A. consist of ecologically and economically (phycocolloid producers) important groups that are also taxonomically challenging, because of their vast species diversity, simple morphology and extensive intra-specific phenotypic variation. Despite the huge amount of classical taxonomic work published across a range of species, many groups remain understudied. This is particularly true at the population level where very little to no information is available about the population structure and phylogeography of seaweeds along the southern Australian coast. In our lab, we are using a combination of classical morphological and modern molecular biology techniques (e.g. DNA sequencing) to solve a wide range of taxonomical, phylogenetical and biogeographical questions about marine macroalgae. Our work extends beyond S.A. and includes several on-going, collaborative research projects with labs in Japan, Brazil and USA.

I am keen to supervise honours students interested in a broad range of phycological topics within the current research framework of my lab. However, if you do not have a project idea of your own, you are extremely welcome to participate in one of the lab's current research programmes such as:

1. DNA barcoding of S.A. taxa:
DNA barcoding in plants uses specific genetic markers (DNA sequences) from chloroplast, mitochondrial and/or nuclear genomes to produce a molecular database that will enables us to solve a wide range of taxonomical problems.

2. Molecular systematics of selected taxa:
Molecular systematics uses a broader range of molecular techniques than DNA barcoding does. In this project, you will be able to use a wide range of genomic regions and markers to help you resolve selected taxonomical problems. Many species await molecular data to have their identity confirmed and their status as new taxa established. Several samples are available in the herbarium for immediate work, and will be augmented by field collections utilising snorkelling, SCUBA and offshore cruises.

3. Evolutionary History & Phylogeography of selected taxa:
The mapping of allele diversity, frequency and spatial distributions can reveal phylogeographical patterns, micro-evolutionary patterns and historic events that help us understanding the speciation process in the marine environment. They also assist in tracing the origin of non-indigenous species and distinguishing "invasive" from "non-invasive" strains.

Prof. Bob Hill	**Evolution of the Australian vegetation, plant macrofossils**
Benham Building	bob.hill@adelaide.edu.au

Australia is one of the great living laboratories in which to investigate the impact of long term climate change. Over the past 60 million years Australia has endured dramatic climate change, covering most imaginable options. The living result is a diverse and unusual vegetation, with roots that extend back into times when Australia was part of the vast land mass known as Gondwana. The impact of past climates on vegetation is preserved in hundreds of plan fossil localities across the continent and many of these are well known, but poorly studied. There is still much to learn about past Australian vegetation, and much of what we can learn can also be applied to predict impacts of future climate changes.

Specific projects available:

1. Impact of high atmospheric CO_2 levels on fossil and living conifers. We have a large research grant from the Australian Research Council to investigate this issue and there are many specific projects on fossil conifers that can be adapted to Honours projects.
2. Vegetation of specific fossil locations. Several fossil deposits exist that have not been well-studied. Projects can be set around all or part of these vegetation reconstructions.

Professor Andrew Lowe **Dr Manfred Jusiatis (DEH)** **Dr Phil Ainsley (DEH)**	**Plant conservation biology**
Darling Building 213	andrew.lowe@adelaide.edu.au

My main research focus is in plant ecological and evolutionary genetics:

1. How do plants survive and adapt to anthropomorphized landscapes?

Gene flow and selection pressures vary across fragmented and exploited landscapes, using a combination of molecular markers, spatial modeling and genomic assessments of adaptive genes (e.g. drought) we can produce habitat management criteria and timber extraction thresholds, for conservation action. This project will undertake an analysis of genetic diversity, mating system and gene flow analysis, using molecular markers, for a tree inhabiting a fragmented landscape in Costa Rica. The results from

this project will be compared with previously obtained growth data for seedling from the field to identify the landscape contexts which result in reduced seedling fitness and viability. The student will use the combination of results to develop best management guidelines for seed harvest across differently impacted landscapes.

2. How do species respond to climate change?

We know from pollen core and phylogeographic results that the historical range of species changed substantially in response to past climatic changes. From monitoring studies in Europe and the US we also know that compared to 50 years ago, today oak trees are flowering 30 days and swallows are migrating 20 days earlier. Yet we know very little about these types of responses for Australian plants. Using the State Herbarium in South Australia as a resource, the student will examine flowering time changes across a range of species for historically sampled specimens (some dating back 150 years), to see if there has been a consistent shift in flowering/fruiting time in response to climatic changes, particularly over the last 50 years. This is the first time this type of data would have been generated for any Australian species.

3. Weeds meet natives - microevolutionary consequences.

Rapid evolution can follow hybridization between invasive and native species, particularly if adaptive genes are transferred. Using the newly invasive plant, fireweed, as a case study example, this project will examine the frequency of hybridisation between fireweed and closely related native plant species (particularly *Sencio pinnatifolius*, with which it has been observed to hybridise) in natural populations. In particular the density of plants has been hypothesised to affect hybridisation ratio and will be tested empirically and through mathematical predictions. The results will be used to predict the likely evolutionary outcome of hybridisation between this weed and Australian native species, and whether fireweed will continue to spread driving native species to extinction.

4. Dropper formation in terrestrial orchids. (Dr Manfred Jusiatis)

The efficient production of healthy, robust plants suitable for translocation is an important component of many endangered orchid recovery programs. Dormant storage organs are the most suitable propagules for optimising translocation success because of their resilience and ease of handling. This project would explore ways of increasing dropper and tuber formation in endangered terrestrial orchids of South Australia by studying the effects of growth regulators and plant hormones on tuberisation.

5. Symbiotic seed germination of terrestrial orchids. (Dr Manfred Jusiatis)

Symbiotic orchid seed germination provides an efficient and reliable way of raising orchids from seed in association with the orchid's naturally occurring mycorrhizal fungus. Orchid seeds do not have an endosperm and hence require an external energy source to initiate seed germination. However, germination can still be erratic and uneven and there is ample scope to improve the speed and uniformity of germination. This study will focus on endangered orchids of South Australia, using seed priming techniques to investigate and attempt to improve germination.

6. Germination requirements of butterfly food species. (Dr Phil Ainsley).

Gahnia and *Lomandra* species are key food sources for native butterflies, however little is known about their seed biology and they are widely regarded as difficult to

germinate. This project aims to identify the dormancy mechanisms in place in selected species and determine methods to promote germination, with the aim of facilitating their inclusion in restoration activities in the south east of South Australia. The project is being offered by the Botanic Gardens of Adelaide Seed Conservation Centre with support from Forestry SA, and will provide a $1,000 scholarship.

7. Can *ex-situ* temperature cycling be used to overcome dormancy in difficult to germinate native plant species? (Dr Phil Ainsley).

It is well known that many native plant species require a period of after ripening to overcome dormancy before becoming responsive to germination triggers. This project aims to determine if dormancy can be overcome under *ex-situ* conditions representative of seasonal temperatures by exposing seeds of the nationally endangered Slender Bell Fruit (Codonocarpus pyramidalis) to various incubation regimes in conjunction with fire related germination triggers. The project is being offered by the Botanic Gardens of Adelaide Seed Conservation Centre in conjunction with the Millennium Seed Bank (UK) and will provide a $1,000 scholarship.

For further information about projects 6 and 7 please contact Dr Phil Ainsley on 8222 9327 or by email (ainsley.phillip@saugov.sa.gov.au). Dr Ainsley is the germplasm research coordinator at the Seed Conservation Centre and an affiliate lecturer with the University of Adelaide in the School of Earth and Environmental Sciences.

Assoc Prof. David Paton **Dr Daniel Rogers**	**Ecology and behaviour of birds, plant-animal interactions; conservation biology; restoration ecology**
Benham Building	david.paton@adelaide.edu.au daniel.rogers@adelaide.edu.au

We have broad interests in terrestrial ecology and behaviour that are all aimed at providing research outcomes that facilitate the management, conservation and restoration of biodiversity. Much of our research investigates spatial and temporal variation in resources, and how these and perturbations like fire and drought influence the distribution, abundance, behaviour and population demography of terrestrial fauna, particularly birds. We have a range of on-going research and long-term monitoring programs being conducted in different areas of the State, and we list some project ideas under each of these. These should act as a guide to the types of projects that could be developed for an Honours degree.

1. Ecology and behaviour of birds in the Coorong

The Coorong is a Wetland of International Significance that is changing as a consequence of a lack of adequate environmental flows. This has lead to the southern Coorong becoming increasingly hypersaline. Key food resources including hardyhead fish and *Ruppia tuberosa* have diminished dramatically but brine shrimps have increased dramatically. Potential projects could investigate the use of brine shrimps as food resources by iconic species such as the Banded Stilt and Red-necked Avocet, or investigate the ecology of Chestnut Teal in the Coorong Lagoons, or study the movements and diets of fish-eating species like cormorants. Other projects could be developed on some of the waders (sandpipers, plovers, oystercatchers and greenshank) that feed in both the estuarine and hypermarine systems. These projects

link to CLLAMMecology, a multidisciplinary research program aimed at determining the eventual ecological responses or recovery of these systems if and when environmental flows are returned to the Coorong. A key component of that work is developing habitat suitability models for key aquatic bird species.

Other potential projects exist in the Coorong based on terrestrial birds and would involve investigating use of space and habitat by co-existing honeyeaters in coastal scrub vegetation.

2. Declining woodland birds, fire and restoration ecology in the Mt Lofty Ranges and Monarto Region

Several potential projects exist within this region.

The first involves documenting how small ground- and shrub-dwelling birds (Superb Fairy-wrens, White-browed Scrubwrens, Chestnut-rumped Heathwrens and Brown Thornbills) respond behaviourally to control burns being conducted by the Dept of Environment and Heritage. This project would consist of documenting patterns of spatial use by the birds prior to the fire and then following the fate of individually-tagged birds and their behaviour post-fire and relative to birds in control areas that were not burnt. Brown Thornbills show a preference for areas with denser vegetation but appear to use *Exocarpos cupressiformes* disproportionately. Another project could consist if confirming this bias and then testing hypotheses to account for their preference.

The second involves documenting the extent to which birds and or selected invertebrates use revegetated and remnant areas in the Willunga region. Many of the plantings in this area consist of dense plantings of a few eucalypt species and may not be particularly valuable in helping to conserve local biodiversity. This project would aim to assess this.

Further projects might aim to document the use of different sized natural hollows in remnant mallee areas and testing hypotheses for any preferences found.

3. Restoration ecology at Arid Recovery, Roxby Downs

Arid Recovery is multi-award winning partnership between the University of Adelaide, BHP Billiton, Dept of Environment & Heritage, and a Friends Group that aims to restore an arid ecosystem to something close to its pre-European condition. Projects on birds, endemic and re-introduced mammals, invertebrates, plant demography, herbivory, and interactions between predators all have the potential to be developed for an honours project. Although ecological restoration in these arid systems takes time, there are a series of enclosures that now contain differing densities of bettongs, bilbies and sticknest rats that allow some experimental comparisons.

4. Influence of fire, drought and topography on flora and fauna in Ngarkat

Ngarkat is a large reserve south of Lameroo and east of Tintinara. This largely mallee-heath system has experienced a series of droughts and extensive fires over the last decade. Projects here would look at assessing the recovery of these heathlands, particularly spatial and temporal (time since fire) variation in recovery. Projects could investigate this recovery from a plant, invertebrate, mammal, reptile or bird perspective, but a plant or invertebrate-based project is probably better for an Honours

degree. We already know that certain locations (the bases of southern and eastern faces of dunes) are more likely to be used by birds and understanding why these patterns exist by looking at plant productivity and invertebrate biomasses may provide the explanation. Various web-forming spiders are also more prominent in mature heaths, greater than 10 years post-fire. So another project could involve investigating the relationships between vegetation structure, plant productivity, invertebrate abundance and spider ecology and behaviour.

5. Use of revegetated areas in the Monarto area.
The Monarto region was planted with a wide range of local and exotic native trees (various eucalypts mainly from Western Australia). Only the tree layer was planted before the revegetation works ceased. This area is gradually being re-colonized by native fauna (birds, brush-tailed possums, invertebrates) and understorey plants, the latter mainly arriving via birds. A range of a potential projects suitable for honours exist building on previous work that has examined patterns of use of the newly established novel woodlands by selected fauna relative to their use of nearby remnants. Future projects could investigate rates and patterns of recruitment of mistletoes, selected invertebrates (ants, wolf-spiders, native bees), birds, reptiles etc. Other projects could investigate patterns to reproductive outputs and recruitment into the existing planted populations.

Assoc. Prof. Fred Recknagel **Dr Russ Shiel** **Dr Scott Mills**	**Ecoinformatics and Watershed Ecology Lab:** **Sustainable management of eutrophication and algal blooms by trophic cascading and shading;** **Constructed wetlands for catchment and stormwater management;** **Ecogenomics by zooplankton;** **Process-based ecosystem modelling and simulation;** **Neural network and evolutionary ecosystem modelling for bioindication, real-time forecasting and early warning**
Benham Building	friedrich.recknagel@adelaide.edu.au russel.shiel@adelaide.edu.au scott.mills@adelaide.edu.au

Projects proposals:
1. Determining food preferences of herbivorous zooplankton on selected algal species being seasonally dominant in Myponga and South Para reservoirs
2. Determining cryptic species of zooplankton by genetic bar-coding of life samples and diapause eggs in Myponga and South Para reservoirs
3. Determining potential of partial shading for algal growth control in farm dams and drinking water reservoirs
4. Ordination, clustering and predictive modelling of macroinvertebrate and diatom communities for bioindication of South Australian stream habitats
5. Understanding diurnal water quality dynamics in the South Para reservoir by on-line monitoring of physical, chemical and biological water quality properties

Assoc. Prof. Rob Reid	**Plant physiology; nutrient uptake, ecotoxicology, plant molecular biology**
Benham Building	rob.reid@adelaide.edu.au

The broad focus of our group is plant physiology, with specific interests in plant nutrition and plant stresses caused by hostile soils or soil-based pollution, and the way in which these stresses can limit productivity or adversely affect human health. Most projects are lab or glasshouse-based, but can involve some aspect of fieldwork. The main techniques used in this work are: (a) measurement of plant growth under favourable and toxic conditions; (b) radioactive tracers to measure uptake and root to shoot transfer of nutrients and other elements; (c) elemental analysis by ICP and colorimetry; and (d) basic molecular biology (database mining, PCR, gene sequencing, analysis of gene expression). There are many projects suitable for an honours year including, but not limited to:

1. Acid Sulphate Soils in the Lower Murray River

The drawing down of water in the Murray River and the lower lakes has exposed soil which can rapidly become very acidic, releasing toxic metals into the environment. Little is known about the extent to which the release from these acid sulphate soils will impact on plant survival and accumulation of toxic metals in plants. The project would examine these issues. There is currently intense interest in this problem, and there may be research funds available to assist with the running of the project.

2. Arsenic in plants.

In many areas of the world, particularly developing countries in Asia, arsenic compounds occur in high concentrations in soil and water, either through the natural geochemistry or via contamination. As a consequence, large numbers of people are being slowly poisoned through drinking water and ingestion of agricultural produce with elevated levels of arsenic. Attempts to limit arsenic in food crops have focussed on how arsenic is absorbed by plants and how it is stored and transported around plants. There is scope for studying the transport processes, the biochemical conversions of arsenic inside the plant, or the molecular biology on which these activities depend.

3. Heavy metal uptake by plants

Excess heavy metal uptake can impact adversely on plant growth and on humans and other animals who ingest plant products containing high concentrations of heavy metals. Relatively little is know about the processes involved in the accumulation and internal transport of heavy metals in plants. However, it is well known that some plants take up very little heavy metal while others take up very large amounts (‘hyperaccumulators’). Physiological investigation of heavy metals and plants could involve examination of the mechanisms of toxicity and/or detoxification, membrane transport or mechanisms or strategies for limiting heavy metal loading into edible plant tissues.

4. Boron toxicity and tolerance in plants

Boron toxicity is a problem for many plants and there have been some recent advances in the understanding of mechanisms of boron tolerance. This work is now mostly being tackled at the molecular level by identifying the genes responsible. Nevertheless there is still much to be learnt about how boron exerts toxic effects, and how tolerant plants are able to deal with the toxicity.

Feel free to propose any topic in the area of soil-plant-nutrition-heavy metal interaction that you think might make an interesting honours project.

Prof. Roger Seymour	**Functional ecology of animals & plants, especially evolutionary adaptations to heat, gas and water exchange**
Darling Building 103	roger.seymour@adelaide.edu.au

I encourage students to develop their own projects within my area of expertise. The best projects evolve from discussions about what interests the student and me at the time. But in case you need ideas, below are a few suggestions that I think would make good Honours projects. They are projects that have not been done before, but are generally quite feasible with the available time and resources. *They would also offer scope for students to expand in their own way.*

1. Heat-producing flowers.

Taking advantage of the resources at the Adelaide Botanic Garden, it would be possible to study the pattern of heat production in the thermogenic flowers of selected species of plants. This would continue a long-term comparative study and may result in the discovery of new thermogenic species. The project would involve thermometry, respirometry and possibly some molecular biology. It is well supported by the ARC and would have to be carried out by a mid-year student, because most blooming occurs in the spring and summer.

2. Diving bugs: role of buoyancy and dissolved gases in diving behaviour of aquatic insects.

Many groups of insects live in water and dive with a bubble of air. This provides oxygen to the insect's spiracles and sometimes permits the absorption of dissolved oxygen from the water (a 'gas-gill'). A bubble has implications for the animal's buoyancy, as well. These factors could be studied in local species with experiments that manipulate gases in the air and dissolved in water. In addition, we now have equipment that can alter the total pressure of the experimental system and therefore change bubble size and hence buoyancy. How do these things affect the diving behaviour?

3. Development of respiration in avian embryos.

One of the hot areas in respiration is the question of whether the changes in the cardiovascular and respiratory systems of birds are 'hard-wired' into the development pattern of the embryos, or whether they can adapt to environmental conditions. This project could approach the question by examining the effect of incubation under altered experimental conditions (e.g. hyperbaric or hypobaric atmospheres, oxygen with carrier gases other than nitrogen that affect diffusion rate, etc.). It could also use

inert gas washout techniques to observe the changes in diffusive and perfusive conductance of the oxygen cascade. Another possibility is novel experiments involving partial blocking of haemoglobin function with carbon monoxide. The student would need a good result in Ecophysiology of Animals to handle this challenge.

4. Growth rates and energetics of hatchling birds.

It appears that the gas conductance by the pores in the bird eggshell limits the rate of oxygen uptake by the embryo, especially in late development. Chicken eggs with high conductance, or those incubated at high oxygen levels produce larger, more mature hatchlings. The practical question is whether this size difference persists after hatching. If it does, it may have enormous commercial significance to the chicken industry, because eggs of high conductance could be selected and they could produce larger chickens in a shorter time. The results would also have implications for the evolution of eggshell conductance. This project would measure the rate of food consumption and growth in hatchings from eggs of difference shell gas conductance. Differences in resting and maximally active metabolic rates could also be measured.

5. Air-breathing fish: oxygen and carbon dioxide exchange in air and water.

Air-breathing in fish evolved at least 60 separate times, and the diversity is enormous. The regulation of air-breathing behaviour appears to be related primarily with aquatic oxygen availability and exercise. My lab has had a program of investigations on the factors governing respiration in gouramis, common aquarium fish. We could develop the project in the direction you wish to go, after studying the literature and previous studies. However, there is scope to examine the role of carbon dioxide. Practically all research on air-breathing fish has involved measurements of oxygen uptake only, so looking at CO_2 would make an important contribution.

Dr David Taggart	**Marsupial / Native rodent - life-history, reproduction, population biology, disease and conservation.**
Adelaide Zoo	david.taggart@adelaide.edu.au 8303-3758

The Royal Zoological Society of South Australia encourages fundamental and applied research in the biological sciences. We have a particular emphasis on conservation. While most of the Society focuses on its two properties, Adelaide Zoo and Monarto Zoological Park, we are increasingly working at other field sites.

I have strong interests in marsupial and native rodent life history, reproductive ecology, assisted reproduction, population biology, diseases and conservation (outside the zoos walls). I am keen to supervise, passionate, high-quality students interested in the fields described above. At present my students and I are working on the following projects.. 'Small mammal distribution and abundance in the Kimberley, WA'; 'Population genetics of rock wallabies in the Kimberley, WA'; 'Effects of habitat fragmentation and inbreeding on fertility of Southern hairy-nosed wombats in SA'; 'Life history and reproductive ecology of the red-tailed phascogale'; 'Site preparation and site management for reintroduction of the Brush-tailed rock wallaby into the Grampians NP'; 'Ecology of the Warru (black-footed rock wallaby) in the APY lands of SA'; 'Development & application of cross fostering techniques to accelerate breeding in the endangered Gilberts potoroo'; 'Cross fostering and pouch young

isolation studies to accelerate breeding in endangered macropods'; 'Seasonal breeding patterns in southern hairy-nosed wombats'; Sarcoptic mange in southern hairy-nosed wombats on the Yorke Penn'; A land systems based management plan for hairy-nosed wombats in the Murraylands of SA'.

If these general areas of research are of interest, then I would be happy to discuss the possibilities of Hons, MSc or PhD projects with you further. In addition to offering supervision, access to Adelaide Zoo and Monarto Zoological Park, and facilities of the Animal Health and Research Centre at Adelaide Zoo, the RZSSA also offers several $1000 scholarships on a competitive basis to encourage graduate research into the biology and conservation. Visit the following website for more details: http://www.adelaidezoo.com.au/AdelaideZoo/WhatsNew/Scholarships.htm

Assoc. Prof. Ian Whittington **Marine Parasitology**

SA Museum (Science Centre, Rm. 3.12) & Darling Building Lab 110
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Dr Kate Hutson **Parasites of recreational & commercial fish**
Darling Building Lab 110
kate.hutson@adelaide.edu.au

Our research interests are in parasites infecting hosts in the marine environment. Ian Whittington's research focus is flatworm parasites of marine fish. Principally, I study biology, ecology and systematics of Monogenea, a class of platyhelminth parasites that principally infect skin and gills of fish. Mostly, I explore biodiversity of Monogenea (i.e. describing and appreciating new species) and use monogeneans on elasmobranch and teleost fish hosts as tractable models to investigate adaptations to, and evolution of, parasitism. Because Monogenea have a direct life-cycle, much can be learned about parasitism by studying their structure, biology, ecology and specific elements of the 'simple' life-cycle to understand how these features interact with their usually highly specific fish hosts. I collaborate with Professor Steve Donnellan and use molecular genetic techniques to investigate parasite phylogeny, parasite-host coevolution and questions about species boundaries.

Kate Hutson's research has particular emphasis on all metazoan parasites of bony fish. You will receive education and practical experience in aquatic animal health management, fish biology, parasitology and taxonomy. This will provide you with preliminary training to work in fisheries, aquaculture, biosecurity and research.

Potential projects exist in the following broad areas, but please note that the first 2 projects are subject to funding outcomes:

1. Coevolution of helminth parasites and their fish hosts (January or mid-year start)

Supervisors: A/Prof. Ian Whittington & Prof. Steve Donnellan

The flatworm parasite, *Benedenia seriolae* (Monogenea), allegedly has a circum-global distribution on wild *Seriola* species (Carangidae) such as yellowtail kingfish, Samson fish and amberjack. The parasite is a significant pathogen of several

commercially valuable *Seriola* spp. in Japan, New Zealand, Australia, Chile, Hawaii and México. However recent molecular genetic data generated in our lab indicates that *B. seriolae* may be a 'species complex'. This project will test this hypothesis and will also study the coevolution of *Benedenia* with their host *Seriola* spp. using host tissue samples collected from around the world. The project will utilise molecular genetic markers developed for the parasites and hosts in our labs.

2. Testing the monophyly of the Monogenea (January or mid-year start)

Supervisors: A/Prof. Ian Whittington & Prof. Steve Donnellan

The helminth Class Monogenea comprises 2 subclasses, the homogenous Polyopisthocotylea (blood-feeders; principally parasites of teleost gills; uniform sperm morphology) and the heterogeneous Monopisthocotylea (epithelial feeders; parasites of disparate sites on elasmobranchs and teleosts; 3 types of sperm morphology). Using representatives of taxa from each of the different sperm morphologies, mitochondrial genes will be explored to compare previous phylogenies for the Monopisthocotylea based on comparative sperm morphology and the distribution of sensilla and ciliated locomotory cilia.

3. Parasites of recreational fishes (January or mid-year start)

Supervisors: Dr Kate Hutson & A/Prof. Ian Whittington

Parasites have potential to limit the growth of Australian fishing industries through mortality, morbidity and reduced marketability. A majority of parasites of recreational Australian finfish have not been collected, studied, reported or described. This project requires rigorous parasite surveys of common recreational species such as Australian salmon, garfish, King George whiting, yellow-fin whiting and tommy ruff from Gulf St Vincent and Spencer Gulf. Some fish may be captured from the wild and maintained in aquaria for further investigation. There will be opportunities to work on 1) taxonomy, 2) host-specificity and 3) parasite pathology.

4. Parasites of wild and farmed mulloway (*Argyrosomus japonicus*) (January start)

Supervisors: Dr Kate Hutson & A/Prof. Ian Whittington

Mulloway, an important commercial and recreational angling species, is currently farmed in sea-cages in Spencer Gulf, South Australia and Botany Bay, New South Wales. Mulloway are particularly susceptible to ectoparasites including monogeneans and copepods. This project involves documenting the parasite assemblage (ecto- and endoparasites) of wild and farmed mulloway from SA and NSW. There is scope to study 1) taxonomy of undescribed species of gill fluke, 2) parasite fecundity and 3) parasite pathology.

5. Other (mid-year start)

There may be opportunities to work on a co-supervised project on fish parasites and climate change with Dr Bayden Russell, Darling Bld, *Southern Seas Ecology Laboratory*.

For more background about the Marine Parasitology group, our interests and key publications, see:

http://www.adelaide.edu.au/directory/ian.whittington

http://www.samuseum.sa.gov.au/page/default.asp?site=1&id=1321

http://www.adelaide.edu.au/directory/kate.hutson