UNIVERSITY of OTAGO

SAPERE AUDE

Te Whare Wānanga o Otāgo

FOREWORD

ZOOLOGY

A university has no more important role than educating the next generation of scientists. In the Department of Zoology we aim to provide our postgraduates with training that meets the highest international standards. Our department strives to provide a bicultural learning environment and encourages partnership between Māori and non-Māori. Our primary goal is to help students learn to do innovative research that is theoretically and methodologically sound.

There are several factors to take into account when choosing where to study for your postgraduate degree. First, you will want to know whether academic staff are active in the area of interest to you. The research interests of our staff are summarised at the back of this booklet and if you would like further details of their research papers, and other scientific publications, we will be happy to provide them.

Second, it is important to be confident that as a postgraduate student you will be provided with the necessary support, both professional and moral, to

Professor Carolyn Burns
(Head of Department)

achieve your full potential. In the Department of Zoology we seek to create a friendly and supportive environment and to involve our research students fully in all academic and social activities. If you wish, we will be happy to put you in touch with one or more of our current postgraduates so that you can gain a student's eye view of life here.

Third, there is the question of whether the environment outside the university is a good one in which to live. Dunedin is a lively and active city with a strong artistic and cultural tradition. It boasts excellent art galleries, museums, theatres, restaurants and gardens. The immediate environment holds great interest for outdoor types. There are large inlets, sandy bays and rocky shores nearby with abundant wildlife - including seals, sealions, penguins and a royal albatross colony all within a few kilometres! Just a few hours travel takes you to glaciers, fiords, mountains and lakes, with all the recreational facilities that these places offer.

If our department meets your basic requirements then read on!

The Department of Zoology welcomes applications from students wishing to undertake postgraduate study.

This booklet outlines the information relevant to the following postgraduate courses in Zoology, Natural History Filmmaking and Communication, and Wildlife Management at the University of Otago:

1. Postgraduate Diploma in Wildlife Management
2. Postgraduate Diploma in Science (Zoology)
3. Postgraduate Diploma in Natual History Filmmaking and Communication
4. Master of Science (MSc) (Zoology)

5. Master of Science (MSc) Wildlife Management
6. Doctor of Philosophy (PhD)

There are currently 39 academic staff members, including 15 postdoctoral research fellows, 6 teaching fellows and our Pou Here Tangata (Māori liaison officer and guide), with research interests in a diverse range of fields. The Department has an active postgraduate programme with about 25 PhD and 30 MSc thesis students currently engaged in research, in addition to more than 47 4th year Honours, MSc and Postgraduate Diploma students.

You are encouraged to make contact with staff members to discuss the content of postgraduate courses and to explore potential research topics for Postgraduate Diploma, MSc or PhD degrees. Written enquiries should, in the first instance, be addressed to:

Professor Carolyn Burns
Head, Department of Zoology
University of Otago
PO Box 56
Dunedin
Tel 64 3 479 7971 (international)
03 479 7971
Fax 64 3 479 7584 (international)
03 479 7584
Email carolyn.burns@stonebow.otago.ac.nz

We are very keen to have more Māori students in our midst. Te Hunga Mātauranga (the University's Māori Centre) will help advise about student life, costs of study, scholarships, course and career choices for Māori. Give them a ring (03) 479-5163 or check out their website at http://www.otago.ac.nz/services/Maori.html. Alternatively you can make contact with the Department of Zoology's Te Roopu group to inquire about opportunities or Māori-oriented research and learning. In that case write to us: Kaiwhakahaere, Te Roopu, Department of Zoology, University of Otago, PO Box 56, Dunedin.

THE UNIVERSITY OF OTAGO

Otago was New Zealand's first university. Founded in 1869, it is older than the majority of universities in the world. While maintaining the best elements of tradition in scholarship and teaching, Otago is progressive and innovative.

The University of Otago is recognised internationally as a leader in many areas of scientific research and has first class status as a teaching institution. No matter what the field of study, the University boasts excellent facilities, whether it be laboratories, field equipment, computing services or libraries.

There are now over 15,000 students on the University of Otago's roll and with more than 70% of them coming from outside the region, Dunedin has its own special flavour as New Zealand's only true university town.

The Department of Zoology is one of the largest and busiest departments in the University and is known nationally and internationally for its research in freshwater ecology, wildlife and conservation ecology, neurobiology and animal behaviour, parasitology, environmental physiology and evolutionary studies.

Our aim is to integrate postgraduate students into both the social and academic life of the Department. In addition, we wish to foster equality of opportunity for all, regardless of age, sex, race, socio-economic status or physical disability. Please let us know of any special needs so that we can make our environment available and friendly to everyone.

The Department effectively blends the architecture and traditions of a long established university with access to up-to-date facilities which include research photomicroscopes, automatic chemical analysers, equipment for isozyme electrophoresis and mitochondrial DNA analysis, histology and radioisotope laboratories, photographic and video facilities, access to transmission and scanning electron microscopes and a wide range of fieldwork equipment. Seven vehicles, a caravan and small boats powered by outboard motors are available for fieldwork. A technical staff of 15 is available for advice and help with the design, building and maintenance of equipment needed for research.

Student computing facilities are provided by the University through Student Computing Services.

Additional computers are also available in the Department for the use of Zoology postgraduate students.

As a postgraduate student you will interact frequently with your research supervisor(s), whose responsibility it is to guide you through the pitfalls of becoming a professional researcher. The relationship can be enormously fulfilling on both sides, and by the time you have completed your degree your supervisors are likely to be learning as much from you as you will be learning from them! Other academic staff within the Department will also take an interest in your work and you will be encouraged to discuss your plans widely and seek feedback from as many people as possible at the various stages of your research.

Regular research student workshops are held to introduce you to topics such as experimental design, statistical analysis, how best to use library resources, effective writing, how to publish a paper and how to prepare a poster for a scientific conference and how to conduct research in a bicultural way. Special emphasis is placed on oral communication and you will have a number of opportunities to talk to a friendly audience about your work. This will culminate, on completion of your studies, with participation in the annual Research Student Colloquium.

Your period of postgraduate study provides an opportunity to develop teaching skills that are likely to be of great benefit in your academic career. As a research student you will be encouraged to demonstrate in undergraduate practical classes (receiving payment at the appropriate salary level).

We consider a training in effective teaching practice to be an integral part of your studies.

Photo: Alison Cree

Duvauchel's gecko *(Hoplodactylus duvaucelli)*

POU HERE TANGATA

The department has appointed a Pou Here Tangata "support between the people". Our Pou Here Tangata acts as a liaison officer and guide to improve partnership between the Department and Māori (iwi). The Pou Here Tangata is able to assist staff and students to develop a closer working relationship with iwi and runanga in areas where there is a commonality of interest, and is supporting the development of bicultural growth in the department. The Pou Here Tangata is supported by a group of staff and students within the Department which is called Roopu Kaitiaki a Pouhere Tangata - we shorten its name to "Te Roopu". This team is there to support Māori students in all aspects of their life and work within the department, but also to help non-Māori students and staff become more bicultural in teaching, research, administration and public service. Check out the Te Roopu section of our website (http://www.otago.ac.nz/Zoology/te_roopu.html) or contact Te Roopu members if you want to be involved or to get some advice on partnership and Tiriti O Waitangi issues.

RESEARCH LINKS

A crucial first step in the planning of a research programme is correct experimental design. Postgraduate students are encouraged to make use of the Centre for Applications of Statistics and Mathematics (CASM). CASM is administered by the Department of Mathematics and Statistics and offers assistance and advice in research design and data analysis. Expert assistance in computing and analysis is also available from staff within the Department.

The study of marine animals is a long-established area of teaching and research activity in Zoology at Otago. Links are particularly strong with the Department of Marine Science which operates the Portobello Marine Laboratory, a well equipped facility which is situated on the eastern shore of Otago Harbour, 25 km by road from the main campus.

The Department of Zoology is involved in collaborative research with other departments in the Sciences and Health Sciences Divisions of the University, the Otago Museum, the Department of Conservation, Crown Research Institutes and other government research agencies.

CAREERS IN ZOOLOGY

There is a wide range of job opportunities in New Zealand open to postgraduates in Zoology. These include positions in:-

- Government departments e.g. Conservation, Fisheries, Environment.
- Regional and local authorities.
- Crown Research Institutes e.g. NIWA, Landcare.
- Medical and veterinary laboratories.
- Wildlife and fisheries management e.g. Fish & Game Council.
- Iwi and other Māori interests.
- Education.
- Scientific publishing.
- Ecotourism.

Many of our graduates are now working overseas.

As a postgraduate student, you will not only acquire specific knowledge about specialist areas of zoology, you will also gain communication, computing, mathematical and analytical skills which are applicable to a wide range of careers.

POSTGRADUATE COURSES IN ZOOLOGY

1. POSTGRADUATE DIPLOMA IN SCIENCE (Zoology)

The Diploma in Science is completed in one year by full-time students and consists of four papers (as specified under MSc papers below) and a research project consisting of original research in an area of the student's own choosing. It is essentially the same course as that followed by Zoology Honours students in their fourth year at Otago and is appropriate for students with a three year BSc degree in zoology, biology or ecology awarded elsewhere, or for mature students returning for a period of advanced study.

Applications for entry to this course should reach the Administrator, Division of Sciences, by 10 December for the following year.

2. POSTGRADUATE DIPLOMA IN WILDLIFE MANAGEMENT

The University of Otago provides an excellent base for wildlife studies, being within easy reach of largely untouched mountains, fiords, rainforests and wetlands, as well as landscapes strongly modified by agriculture and industry. There are several rare or endangered species within a few kilometres of the campus including albatross, yellow-eyed penguins and Otago skinks. The University has a very strong concentration of ecologists, many of whom are active in research on wildlife species and endangered habitats.

The major objective of the Diploma is to train students with the skills necessary for employment in some aspect of wildlife or ecological management or research. Other important goals of the course are to develop in students:

- an understanding of the ecological basis of conservation, harvest management and pest control;
- an understanding of the statistical basis for experimental design and sampling procedures;
- planning and execution of scientifically sound studies;
- an appreciation of the practical realities of wildlife management from administrative and legal points of view;
- an appreciation of the need for a bicultural approach to wildlife management;
- a knowledge of the biology, ecology and behaviour of wild animals in New Zealand; and
- skills in communicating about the management and scientific research of ecological communities. Verbal presentations, debating, dealing with the media, popular science writing and scientific report writing are all emphasised and taught.

Course content is a mixture of seminar material and "hands-on experience" gained through fieldwork. Students are responsible for designing and carrying out various wildlife surveys and then writing reports about the outcomes.

Course Outline

The Postgraduate Diploma in Wildlife Management is normally a one year full-time course usually commencing in February, however it is also possible to study part-time for the Diploma, or to commence study in July.

Candidates for admission will normally possess a degree in zoology, biology or ecology, and will have attained a standard that satisfies the University Senate of their ability to undertake the course. Candidates with experience in wildlife management or administration, but lacking a degree, are also encouraged to apply.

The Diploma is designed to be flexible and offer maximum choice so as to cater for the different career aspirations, wildlife interests and academic backgrounds of participating students.

All students must take "Principles of Wildlife Management", "Techniques of Wildlife Management" , "Data Analysis for Wildlife Management" (for those who have not completed ZOOL 316) and three or four other papers.

WILM 401: Principles of Wildlife Management (8pts, compulsory)
A seminar style course covering the main principles of ecological science and how they can be applied to solve issues of conservation, harvesting or pest control of animal species. Accent is on the practical constraints facing managers and wildlife research groups, and environmental philosophies behind their work. Ways to achieve community involvement and bicultural approaches are considered, as are wildlife management career options. There will be a 3 day field trip in August and an overnight stay at a marae (Māori meeting place). Students will be expected to pay up to $50.00 to defray expenses for the field trip and marae visit. Seminars and discussions are on Monday mornings and Tuesday afternoons throughout the second semester.

WILM 402: Techniques of Wildlife Management (8 pts, compulsory)
In this course we teach practical skills of wildlife management and research such as: identifying and counting animals, designing survey and monitoring schemes, catching and marking animals, predator control, data analysis and interpretation, report writing and communication skills. The course gives hands-on experience, wherever practical, of real-life management issues involving New Zealand animals. It includes seminars, group projects and several field excursions where you will actually do the necessary survey, animal capture etc. During the course you will learn density estimation with line transects and radio-telemetry methods. This course is particularly recommended for those of you who eventually want jobs in ecological research teams, or as fish and game field officers, conservation officers or pest controllers. It will also be useful for those of you aiming at research scientist careers or postgraduate (MSc of PhD) study. WILM 402 is only available to Diploma in Wildlife Management students.

WILM 403: Practice in Wildlife Management (8 pts)
This paper is designed for those wanting frontline wildlife management positions at the end of the Diploma year. It gives you five weeks' work experience in some wildlife management organisation, or as a research assistant. This should allow you to assess the practical realities of wildlife management in a way that the university cannot teach. Your employer also gets a chance to look at your talents and sometimes this had led to them hiring the student. You could be based anywhere in

NZ, or overseas. Students have worked in South Africa, Australia and Alaska, as well as in several locations in New Zealand. This paper is only available for Diploma in Wildlife Management students.

WILM 404: Data Analysis for Wildlife Management (8 pts, compulsory for PGDipWLM students who have not passed ZOOL316)
This paper gives you the statistical skills essential to ecological research and wildlife management. You will learn about many aspects of experimental design and data analysis, and how to use various statistical packages on the computer. This paper is based on the lectures, assignments and examination for ZOOL316 (Biological Data Analysis and Computing) but, in addition, you will be given a database and objective which you must achieve using the skills you have gained in class. Approval from the Head of Department is required for non-PGDipWLM students.

ZOOL 417: Harvest Management (8 pts)
The main goal of the Harvest Management paper is to introduce the key concepts of sustainable use of renewable natural resources. Through real life examples we will evaluate sustainability of different harvests and identify the factors most influencing the management of a variety of resource use systems. The paper is seminar based and students will be required to prepare and give seminars, and to contribute to discussions. Seminars will be given or facilitated by invited speakers.

ECOL 311: Conservation Biology: Threats to species and communities (6 pts)
This course looks at the ecological and genetic principles underlying biological conservation, the rationale for conservation, population dynamics and genetics of small populations and threats to species in the form of human population growth, climate change, invasive species, pollution, genetically modified organisms, and ecological economics.

ECOL 311 is highly recommended for students with a lot of practical management experience, but little formal zoological or ecological learning. Alternatively, students may take the paper to help build on their existing knowledge.

Any other paper can be chosen from the range of MSc papers outlined below. Alternatively, students may consider Planning, Marketing, Economics, Botany, Mathematics, Sociology, Political Studies, Psychology and Geography papers. Students are encouraged to study the University Calendar for relevant papers in these disciplines.

The closing date for applications is 1 October for those who require a study permit for entry into New Zealand and 1 November for other applicants.

More information regarding the course can be found at our homepage http://www.otago.ac.nz/zoology/pg/wildlife.html or by writing to:

Dr Philip Seddon
Course Director
Postgraduate Diploma and Masters in Wildlife Management
PO Box 56
Dunedin
New Zealand
Email philip.seddon@stonebow.otago.ac.nz

3. POSTGRADUATE DIPLOMA IN NATURAL HISTORY FILMMAKING AND COMMUNICATION

The University of Otago's Postgraduate Diploma in Natural History Filmmaking and Communication is a one year postgraduate course that has been developed in partnership with Natural History New Zealand Ltd. The course of study consists of six papers. There are four core papers:

NHFC 401: The Techniques of Natural History Filmmaking
Dealing with the process of making a natural history documentary, this paper covers technical aspects of natural history filmmaking such as the use of equipment and the roles of those involved. It aims to nurture appropriate filmmaking skills and an awareness of issues associated with filming wildlife (e.g. ethical aspects of working with animals).

NHFC 402: The Craft of Natural History Storytelling
An ability to tell stories is the core requirement for the communication of science and natural history. This paper explores the structure of successful storytelling and aims to equip participants with key skills needed to take an idea and develop it into a script.

NHFC 403: Biology as Natural History
This paper examines how natural history can be communicated most effectively. While concentrating on the role of natural history documentaries as vehicles for conveying biological science to the public, it also considers other forms of media, including magazines, books, museum displays and the internet.

NHFC 404: Internship in Natural History Filmmaking and Communication
This involves a 6-8 week part-time internship at an appropriate facility where the student takes part in an approved aspect of natural history filmmaking or an approved alternative involving the communication of science.

Eligibility
The course is restricted to a maximum intake of 12 students per annum. Applicants must have a university degree (although consideration may occasionally be given to those with equivalent work experience) preferably in biology or, at least, containing courses of a biological nature. Other qualifications or experience in film, photography, popular writing or design may also be an advantage.

Dunedin is the wildlife capital of New Zealand with colonies of seals, albatross and penguins all living within the city's boundaries. It is perhaps no accident, therefore, that it has also become a centre for those involved in natural history filmmaking and popularising science.

Dunedin-based **Natural History New Zealand Ltd** is the second-largest producer of natural history films in the world. A number of other companies producing natural history material have also made Dunedin their home, as have many of New Zealand's foremost natural history writers. Combining the special natural, commercial and human resources available in Dunedin with the academic strengths of the University of Otago enables us to offer a unique qualification in Natural History Filmmaking and Communication. This is the world's first University based qualification in Natural History Filmmaking.

The Postgraduate Diploma in Natural History Filmmaking and Communication focuses on the elements of successful natural history filmmaking and communication. The course will support a range of career options, including: natural history filmmaking; the production of educational materials; science journalism; museum and display work; and public relations for organisations that deal with wildlife or environmental issues.

More information regarding the course can be found at our homepage http:/www.otago.ac.nz/zoology/naturalhistory/index.html or by writing to:

Associate Professor Lloyd S. Davis
Course Director
Postgraduate Diploma in Natural History Filmmaking and Communication
Department of Zoology
University of Otago
PO Box 56
Dunedin
New Zealand
Email naturalhistory@otago.ac.nz

4. MASTER OF SCIENCE (MSc)

The degree of Master of Science is awarded on a research thesis alone or, more usually, by passing appropriate papers in the first year (as below) and submitting a thesis after a further year of research. Suitable research topics for the thesis should be discussed with academic staff. A list of their research interests is given later in this booklet, and a thesis topics booklet is available from the department. Students are required to have arranged a thesis topic and supervision before enrolment.

The prerequisite for entry to the MSc by papers and thesis is a BSc degree, normally in zoology, ecology or biology. Applications for entry to this course should reach the Registrar by 10 December. Applications for the MSc by thesis only can be submitted at any time. To be eligible for the latter degree students must have completed a four year Honours degree or an ordinary degree followed by a Postgraduate Diploma. Entry is dependent on the quality of previous research experience and academic performance.

Papers
Students enrolled for a Postgraduate Diploma in Science are required to take four papers. Those in the first year of a Masters degree are also required to take the relevant 495 (Thesis preparation) paper. Teaching is normally by directed reading, seminars and essays.

ZOOL 410: Evolutionary Genetics (8 pts)
This paper deals with contemporary issues in evolutionary genetics. Emphasis is placed on our understanding of species and speciation, as well as defining genetic units for conservation and the identification and conservation value of hybrids. Some familiarity with basic concepts in population genetics will be useful.

ZOOL 411: Behavioural Ecology and Evolution (8 pts)
This course will evaluate current major controversies and theoretical issues in the area of behavioural and evolutionary ecology. For example, adaptive explanations have a central role in our understanding of evolutionary biology, but do we use them too freely? We will look at controversies about the legitimacy and utility of the adaptationist programme, along with other current issues such as fluctuating asymmetry and human mate choice.

ZOOL 412: Neurobiology and Behaviour (8pts)
Behaviour has been sculpted by evolution to optimise an animal's success in its own natural environment. Animal diversity can be used to provide fundamental insights into principles of neural systems and brain function. This paper examines how the brain controls behaviour, and it explores the impact that changes in the environment can have on the structure and function of the brain. Systems that have been studied in this paper in recent years include electrolocation by sharks and electric teleosts, auditory localisation by bats and owls and visual processing in frogs. Neural mechanisms underlying learning and memory, age-polyethism in honey bees, and insect metamorphosis are also topics that are frequently considered.

ZOOL 413: Environmental Physiology (8 pts)
In this paper the physiological mechanisms that enable vertebrates and invertebrates to survive in extreme environments are examined. Topics may include: small mammals in the cold; mammalian life in the high arctic; survival in dry and salty environments; cold tolerance and desiccation survival in invertebrates and temperature-dependent sex determination in reptiles.

ZOOL 414 Comparative Physiology (8 Pts)
This paper focuses on issues in reproductive physiology of vertebrates. The major themes are stress and reproduction, hormones in the embryonic environment, sex determination and molecular reproduction. Although the main emphasis is on comparative endocrinology, applied aspects (e.g. for wildlife conservation and aquaculture) are considered.

ZOOL 415: Parasitology (8 pts)
In an agricultural economy, such as New Zealand's, an understanding of parasitic diseases is of considerable practical importance. Study of the complex interactions between hosts, parasites and the environment has also given important insights into basic biological processes. Topics covered may include: host/parasite population dynamics; the impact of parasites on host behaviour and evolution; the control of nematode infections of sheep; biological control and parasite ultrastructure.

ZOOL 416: Freshwater Ecology (8 pts)
In this course specific topics in freshwater ecology are developed in depth and are chosen to reflect the interests of participating students. Themes have included the interactions among organisms in lakes and rivers, from microbes to fish, the influence of land uses and climate change on aquatic communities and the conservation, restoration and management of freshwater ecosystems.

ZOOL 417: Harvest Management (8 pts)
The main goal of the Harvest Management paper is to introduce the key concepts of sustainable use of renewable natural resources. Through real life examples we evaluate the sustainability of different harvests and identify the factors most influencing the management of a variety of resource use systems. The paper is seminar based and students will be required to prepare and give seminars and to contribute to discussions. Seminars will be given, or facilitated by, invited speakers.

ZOOL 420: Special topic in Zoology (proposed – 8 pts)
In this course, students will be exposed to the basic principles of molecular biology and their applications to answer questions concerning metabolism, reproduction, development and/or neurophysiology. There will be a significant laboratory component for the first two weeks of the semester (Semester 2) to come to grips with the "molecular language" and to become acquainted with an array of techniques. We will use this basis to then explore how genes are regulated and how gene function evolved in the animal kingdom.

WILM 401: Principles of Wildlife Management (8pts)
A seminar style course covering the main principles of ecological science and how they can be applied to solve issues of conservation, harvesting or pest control of animal species. Ways to achieve community involvement and bicultural approaches are considered, as are wildlife management career options. There will be a 3 day field trip in August and an overnight stay at the marae (Māori meeting place). Students will be expected to pay up to $50.00 to defray expenses for the field trip and marae visit. Seminars and class discussions are on Monday mornings and Tuesday afternoons throughout the second semester.

First places in this course are reserved for PgDipWLM students to allow them to complete their course requirements, but BSc Honours and MSc students from Zoology, Marine Science, Environmental Science, Ecology, Geography or Botany are very welcome to fill remaining spaces (class size is limited to 16). If you want to take the course but are not a WILM student, apply in writing to the Head of the Department of Zoology by the last day of enrolment week at the start of Semester 1. Places will be allocated on that day according to the relevance of the WILM401 course to the student's research project or career plans.

ZOOL 495: Masters Thesis Preparation (8pts)
Preparation and presentation of a thesis proposal and preliminary thesis research.

Research Thesis
In working towards your research thesis you will develop a number of important skills. You will be encouraged to develop the ability to communicate effectively in writing and to present clear and well illustrated talks - both are crucial to a professional zoologist. You will also learn to make efficient use of the scientific literature related to your research topic and become an expert in your chosen area. We can guide you on how to research a topic of substantive interest to Māori or to communicate the results back to the Māori community in a culturally appropriate manner. Finally, and most importantly, you will acquire expertise in experimental design, statistical analysis and critical interpretation of results from an original piece of research. Masters students are encouraged to publish their thesis research in international scientific journals. Some examples of recent thesis titles are given later in this booklet.

River fish survey

5. DOCTOR OF PHILOSOPHY (PhD)

A doctorate is the ultimate step in university education. Those awarded the degree will become the next generation of researchers, university teachers and leaders in science. The prerequisite for entry into the PhD programme is a BSc Honours or MSc degree in which performance has been of a sufficiently high standard to satisfy the University Senate of the student's ability to successfully complete a doctorate.

The degree is awarded upon the presentation of a thesis after a minimum of two and a half years of full-time research or four years of part-time research. The research is conducted under the supervision of one or more members of the academic staff of the Department of Zoology. A joint supervisor may also be a member of academic staff from another department or research organisation (e.g. Department of Conservation or Crown Research Institutes). There is no compulsory course work associated with the PhD, but students are able to pursue their interests by taking postgraduate courses such as those outlined in the MSc section of this booklet.

As a PhD student you will learn how to identify a problem and devise some significant hypotheses, design a series of experiments and observations to address these hypotheses, analyse data in an appropriate manner, interpret results critically and place your work into the context of the existing literature in your field of research. You will develop expertise in written and oral communication, with the ability to argue a difficult scientific case and to spot weaknesses in other people's arguments. Close support, particularly in the early stages of work, is available to PhD students from their research supervisor(s), an appointed advisory group and others in the Department. However, past experience has shown that PhD students gradually acquire the skills and confidence required until they are fully on a par with their supervisors.

FINANCIAL SUPPORT FOR MSc AND PhD STUDENTS

Three categories of financial support are available.

Postgraduate Scholarships are awarded to candidates for the degree of Doctor of Philosophy. Normally the minimum standard required is an average grade of high A- or above in the fourth year of an Honours degree, or in a postgraduate Diploma or equivalent, or in a Master's degree. Tenure is for up to three years (subject to satisfactory performance) and the scholarship consists of an annual emolument ($20,000 at the time of going to press), payment of tuition fees (at the level payable by New Zealand citizens) and a one-off refund of up to $550 for thesis preparation.

Postgraduate awards are awarded to candidates for a Master's degree involving the preparation of a thesis. Normally the minimum standard required is an average grade of high B+ or above in the fourth year of an Honours degree, or a postgraduate Diploma or equivalent. Tenure is for one year and the award consists of an emolument ($13,000 at the time of going to press), payment of tuition fees (at the level payable by New Zealand citizens) and a refund of up to $300 for thesis preparation. The award can be held only in the first year of full-time research for a Master's degree.

Division of Science Awards may be held by PhD and Master's students. They are granted for one-three years and consist of an annual grant ($5,100 at the time of going to press) and payment of tuition fees (at the level payable by New Zealand citizens). Applicants should have achieved an average grade of B or higher in the fourth year of an Honours degree, or a Postgraduate Diploma or equivalent, or for a Master's degree. The required level is subject to annual review.

Applicants can obtain full details from:

Scholarships Section
Research, Enterprise and International Office
University of Otago
PO Box 56
Dunedin
Email pgschols@otago.ac.nz

Applications must be received by the Postgraduate Scholarships Administrator no later than 1 October.

Important notes:

(i) All applicants, whether or not they are currently studying at the University of Otago, should make contact with the Head of Department of Zoology to discuss their plans prior to submitting the application.

(ii) Applicants currently studying at other universities must attach a certified copy of their academic record to the application form.

(iii) International students should note that the tuition fees covered by scholarships and awards are paid at the New Zealand level only. At present, tuition fees for a postgraduate course in Zoology are set at NZ$3,740. Full international fees can be as high as US$9,500, leaving a difference of up to $14,500 to be funded by the student. International students should contact the International Office international@otago.ac.nz or http://www.otago.ac.nz/international to enquire about applying for a place at the University. Māori scholarships are available for students of Māori descent, even where the whakapapa (genealogical) link is quite distant. Contact our Te Roopu group for details or see Te Hunga Mātauranga (the Māori Centre) for details.

SELECTED TITLES OF RECENT POSTGRADUATE THESES

PhD

Sheena Brown	Ultrastructural analysis of activity dependent volume changes in the antennal lobe of the worker honey bee, *Apis mellifera.*
Paul Scofield	Density dependence and survival of Sooty Shearwaters *Puffinus griseus.*
Brent Sinclair	The ecology and physiology of New Zealand alpine and Antarctic arthropods.
Bruno David	The distribution and habitat use of fish in the lower Taieri catchment with particular reference to the Giant Kokopu.
Claudine Tyrrell	Reproductive ecology of northern tuatara *(Sphenodon punctatus punctatus).*
Catherine Hall	Effects of tidal intrusions of seawater on the crustacean zooplankton community of a tidal coastal lake.

MSc

Otto Aalders	*Anisakis* in seafood processing: infection in two commercial species and the cold tolerance of this parasitic nematode.
Kyleigh Couch	Diapause in a Southern Hemisphere calanoid copepod, *Boeckella triarticulata* Thomson.
Claire Donovan	Regulation of steroidogenesis in follicles of the rainbow trout *(Oncorhynchus mykiss).*
Natasha Grainger	Fire ecology of a pakihi terrace, Westport, South Island, New Zealand.
Paul Leisnham	Meta-population dynamics and life history traits of mountain stone weta *Hemideina maori* in the Rock and Pillar Range.

Leigh Marshall	Home ranges and activity patterns of sympatric Grand and Otago skinks.
David Latham	Ecology of acanthocephalan infections in shore crabs.
Thomas Mattern	Foraging strategies and breeding success in Little Penguin, *Eudyptula minor:* a comparative study between different habitats.
Angus Small	Investigating possible causes of hatching failure of takahe on island refuges.
Ilka Sohle	Satellite telemetry of sooty shearwaters *(Puffinus griseus)*: Techniques and duration of transmitter attachment, behavioural effects and movements.

PGDipSci

David Latham	Influence of parasitism on the stalk-eyed mud crab, *Macrophthalmus hirtipes* (Ocypodidae).
Shelley Martin	The development of the fruit fly, *Drosophila melanogaster,* and the structure and development of its mushroom bodies.

STAFF RESEARCH INTERESTS

Dr Phil Bishop
Email phil.bishop@stonebow.otago.ac.nz
Research interests
- Communication in amphibians.
- The global phenomenon of declining amphibian populations.
- The behavioural ecology of amphibians.

Current projects
- Chemical communication in Leiopelmatid frogs.
- Past and present distributions of New Zealand frogs - The New Zealand Frog Survey.
- Conservation management of native frogs.

Professor Carolyn Burns (Head of Department)
Email carolyn.burns@stonebow.otago.ac.nz
Research interests
- Biological processes in lakes and wetlands, particularly trophic interactions.
- Microbial food webs.
- Eutrophication and water quality.
- Plankton ecology.

Current projects
- Benthic-pelagic coupling in lakes and wetlands.
- Suspended sediments and pelagic processes.
- Behaviour and life history strategies of freshwater crustaceans.
- Predation and population dynamics of zooplankton.
- Cyanobacteria-zooplankton interactions.

Dr Gerry Closs
Email gerry.closs@stonebow.otago.ac.nz
Research interests
- Ecology of freshwater fish.
- Fish-invertebrate interactions.
- Habitat use of fish and freshwater invertebrates.
- Dynamics of lake littoral communities.
- Population dynamics of diadromous fish.

Current projects

- Littoral community dynamics in large lakes.
- Habitat use and behaviour of giant kokopu.
- Life history and population dynamics of diadromous fish.
- Impacts of European perch in wetlands.
- Factors influencing fish-grazer-algae interactions.
- Population dynamics of mysid shrimps in estuarine systems.

Dr Alison Cree (MSc Research Student Co-ordinator)
Email alison.cree@stonebow.otago.ac.nz
Research interests

- Vertebrate reproduction.
- Environmental and comparative physiology.
- Conservation biology.

Research

- Reproduction of female reptiles in cold climates.
- Environmental and endocrine influences on gestation length in lizards.
- Stress endocrinology.
- Sex determination and sexual differentiation in reptiles.
- Biology and conservation of New Zealand reptiles.

Associate Professor Lloyd Davis (Director of Natural History Filmmaking and Communication)
Email adelie@stonebow.otago.ac.nz
Research interests

- The behavioural ecology of birds and mammals, especially sexual selection and kin selection.
- Sperm competition and mating patterns of seabirds.
- Behavioural rhythms.
- Primate sociobiology.
- Behaviour of penguins and seals.

Current projects

- Brood reduction in crested penguins.
- Ecological constraints and life history patterns of little penguins.
- Maternal investment and foraging ecology of New Zealand fur seals.
- Breeding biology and brood reduction in erect-crested penguins.

Dr Ian Jamieson (400-level co-ordinator)
Email ian.jamieson@stonebow.otago.ac.nz
Research interests
- Behavioural ecology and small population dynamics of endangered species of birds.

Current projects
- Effects of inbreeding in translocated island populations of endangered takahe, robins and saddlebacks.

Dr Mark Lokman
Email mark.lokman@stonebow.otago.ac.nz
Research interests
- Evolution of physiological control of reproduction.
- Placentation in fishes.
- Hormones and metamorphosis.
- Steroidogenesis.

Current projects
- Role of 11-ketotestosterone in oogenesis and metamorphosis in eel.
- Physiological changes occurring with pregnancy in seahorses.
- Role of growth factors on oogenesis of eel.
- Control of steroid production in starfish.
- Temperature and growth in crayfish and paua.

Professor Alison Mercer (Postgraduate Student Co-ordinator)
Email alison.mercer@stonebow.otago.ac.nz
Research interests
- The modulatory role of biogenic amines and their contribution to the regulation of neuronal development.
- Olfaction and the central processing of olfactory information.
- Brain and behaviour of honey bees.
- Learning and memory in invertebrates.

Current projects
- Characterisation of amine receptors in the insect brain.
- Analysis of dopamine and serotonin modulation of central olfactory neurons.
- Structure, function and development of the olfactory system of the honey bee.

Dr Henrik Moller
Email henrik.moller@stonebow.otago.ac.nz
Research interests
- Population ecology, behavioural ecology and control of pests of New Zealand's endemic biota.
- Wildlife management.
- Conservation.
- Mātauranga Māori, Traditional Environmental Knowledge and Kaitiakitanga.

Current projects
- Manipulation of predator/prey interactions for conservation management.
- Sustainability of titi (muttonbird) harvests by Rakiura Māori.
- Co-management of conservation by iwi, business interests and local groups.

Dr Mike Paulin
Email mike.paulin@stonebow.otago.ac.nz
Research interests
- Brains, biomechanics and animal agility.
- Cerebellar function.
- Computational models.

Current Projects
- Vestibular coding – how neurons represent movement.
- Dynamics of animal locomotion.
- Building of agile robots and computer animations.
- Interactive 3D models for research on complex biological systems.

For more information visit my lab website:
http://www.otago.ac.nz/zoology/MGP/index.htm

Associate Professor Robert Poulin
Email robert.poulin@stonebow.otago.ac.nz
Research interests
- Evolutionary ecology of parasites.
- Evolution of parasite transmission strategies.
- Effect of parasites on host reproductive success (i.e. mate choice, parental care).
- Biodiversity and biogeography of parasites.
- Manipulation of host behaviour by parasites.

Current projects
- Parasites and reproductive success in freshwater fish.
- Effect of parasites on behaviour of invertebrates.
- Ecological effects of parasitism in the intertidal zone.

Dr Phil Seddon (Director of Wildlife Management)
Email philip.seddon@stonebow.otago.ac.nz
Research interests
- Restoration of threatened species.
- Resource selection and habitat use.
- Assessment of environmental impacts of nature-based tourism.
- Breeding ecology of sea birds.

Current projects
- Restoration of black stilts (kaki).
- GIS and remote sensing applications for wildlife management (collaboration with R. Mathieu, School of Surveying).
- Human disturbance impacts on coastal wildlife.

Dr Liz Slooten
(Director of Environmental Science)
Email liz.slooten@stonebow.otago.ac.nz
Research interests
- Estimating abundance, survival and reproductive rates.
- Population viability analysis.
- Marine mammal bycatch and other environmental impacts of fishing and aquaculture.
- Effects of tourism on marine mammals.

Current projects
- Abundance surveys for Hector's dolphins and sperm whales.
- Population biology of Hector's dolphins and sperm whales.
- Population viability analysis for Hector's dolphin.
- Assessment of the effectiveness of the Banks Peninsula Marine Mammal Sanctuary.
- Environmental effects of aquaculture.

Associate Professor Hamish Spencer
Email hamish.spencer@stonebow.otago.ac.nz
Research interests
- The maintenance of genetic variation in populations.
- The population genetics of genomic imprinting.
- New Zealand molluscs.
- History of eugenics.
- Applications of phylogenetics to New Zealand taxa.
- Population-genetic theory of frequency-dependent selection.
- Population genetics of maternal effects.

Current projects
- Population-genetic models of frequency-dependent selection.
- Evolution of genomic imprinting and other non-Mendelian systems.
- Population-genetic theory of genomic imprinting.
- Population-genetic models of maternal selection.
- Co-evolution of topshells and their trematode parasites.

Professor Colin Townsend
Email colin.townsend@stonebow.otago.ac.nz
Research interests
- The ecology and behaviour of invertebrates and fish in streams.
- The influence of land-use on river ecosystems.
- The impact of flow disturbances on stream communities.

Current projects
- The impact of land-use on the ecology of the Taieri River.
- The influence of physical disturbances on stream food webs.
- Interactions in streams between native and introduced species.
- Relative roles of atmospheric and geological nitrogen in stream ecosystems.

Dr Yolanda van Heezik
Email yolanda.vanheezik@stonebow.otago.ac.nz
Research interests
- Captive management as a species restoration tool.
- Resource selection and habitat use.
- Urban wildlife.

Current projects
- Captive management of black stilts (kaki).
- Pre-release preparation of avian re-introduction candidates.
- Resource use in urban habitat mosaics by native birds.

Associate Professor Graham Wallis
Email graham.wallis@stonebow.otago.ac.nz
Research interests
- Molecular systematics and biogeography.
- Genetics of hybrid zones.

Current projects
- Evolutionary genetics and systematics of native galaxiid fish.
- Evolutionary genetics and systematics of native insects.

Associate Professor David Wharton
Email david.wharton@stonebow.otago.ac.nz
Research interests
- Environmental physiology of nematodes.
- Cold tolerance of invertebrates.
- Anhydrobiosis (life without water).
- Organisms in extreme environments.
- Ultrastructural and microscopial techniques.

Current projects
- The role of ice-active proteins in cold tolerance.
- Intracellular freezing in an Antarctic nematode.
- Anhydrobiosis in the garlic eelworm.

For more information on the Department of Zoology please write to;

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or check out our website: http//www.otago.ac.nz/Zoology/