School of Biology

Head of School

Professor D Paterson

Postgraduate Programmes

M.Phil.:	Behavioural and Neural Sciences
M.Res.:	Environmental Biology
	Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences
	Marine Mammal Science
	Marine Systems Science

Programme Requirements

Environmental Biology

M.Res.:	BL5015, BL5018, BL5019, BL5021, ID5005, ID5011 or ID5012, MT5752, MT5753 and 3 of the following: BL5009, BL5010, BL5011, BL5012, BL5013, BL5123, MT5751

Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences

M.Res.:	BL5015, BL5018, BL5019, BL5008, ID5005, ID5011 or ID5012, MT5752, MT5753 and 3 of the following: BL5009, BL5010, BL5011, BL5012, BL5013, BL5123, MT5751, MT5754, MT5755

Marine Mammal Science

M.Res.:	BL5103, BL5104, BL5111, BL5112, BL5201, BL5202, MT5753 and two of the following: BL5010, BL5011, BL5121, BL5122, BL5123, MT5751 plus 60 credits from BL5199

Marine Systems Science

M.Res.:	BL5021, BL5301 - BL5303, 30 (or 35) credits from BL5321, ID5011, MT5753, and 30 credits from BL5322 - BL5324: plus 60 credits from BL5399

Behavioural and Neural Sciences

M.Phil.:	This programme is offered by direct entry to the second year of an MPhil only. Entry is restricted to candidates with a good first degree (2.1 or equivalent) in a relevant discipline (which should normally have included significant elements of both behavioural and neural sciences approached from the perspectives of Biology and/or Psychology). The programme comprises a 40,000 word research thesis.

Modules

BL5008 Basic Concepts in Ecology and Evolution

Credits: 15 Semester: 1 (3 weeks)

Programme(s): Compulsory module for M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programme.

Description: The central objective of the module will be to provide an overview of the elements of ecology and evolution that apply directly to environmental issues. The ecology section (6 lectures) will address single-species populations and their growth, competition and its consequences, and predation and related processes. The evolution section (6 lectures) will address variation and its genetic basis, selection, sociality, and sex. This will enable students to achieve a synthesis between their previous training and modern approaches to ecology and evolution, as a prelude to the more specialist topics in later modules.

Class Hour: To be arranged.

Teaching: Four lectures and one tutorial each week for 3 weeks.

Assessment: Continuous Assessment = 40%, One-and-a-half Hour Examination = 60%

BL5009 Plant Responses to their Environment

Credits: 10 Semester: 1 (2 weeks)

Programme(s): Optional module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Description: This module examines the ways in which plants interact with their physical, chemical and biological environments, and how human beings influence these interactions. Examples of responses at the cellular and molecular level will be examined within the wider context of the response of the whole organism to different environmental conditions, and particular emphasis will be placed on formulation of hypotheses and on experimental methods. The aim is to provide the student with a knowledge of fundamental plant processes and of how the environment influences plant growth in 'nature' and in agricultural systems.

Class Hour: To be arranged.

Teaching: Three lectures, one tutorial and one practical each week for 2 weeks.

Assessment: Continuous Assessment = 40%, One-and-a-half Hour Examination = 60%

BL5010 Marine Ecology and Physiology

Credits: 10 Semester: 1 (2 weeks)

Programme(s): Optional module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences and M.Res in Marine Mammal Science Postgraduate Taught Programmes.

Description: This module will investigate how simple Newtonian mechanics and consideration of scale can explain many important phenomena at the level of cells, tissues, whole animals and the large scale properties of ecosystems. The lecturers will illustrate the principles with respect to their own research on muscle growth and locomotion, ion and water transporting epithelia, the distribution and behaviour of pelagic organisms and larval recruitment. This theme allows the introduction of central ecological and physiological issues in a context relevant to the previous experience of the participants.

Class Hour: To be arranged.

Teaching: Three lectures, one tutorial each week for 2 weeks and one practical class.

Assessment: Continuous Assessment = 40%, One-and-a-half Hour Examination = 60%

BL5011 Conservation Biology

Credits: 10 Semester: 2 (2 weeks)

Programme(s): Optional module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Description: This module will cover the measurement of biodiversity, the meaning of biodiversity, factors determining extinction risk for local populations, and the effect of spatial variation on biodiversity. Practical sessions will include an introduction to diversity measurement (including sampling issues, computer packages and interpretation of output), population viability analysis, and the use of "environmental futures" to guide research strategies.

Class Hour: To be arranged.

Teaching: Five lectures each week for two weeks, one tutorial, one practical class and one workshop.

Assessment: Continuous Assessment = 40%, 2 Hour Examination = 60%

BL5012 Environmental Genomics

Credits: 10 Semester: 2 (2 weeks)

Programme(s): Optional module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Description: In general terms, this module will consider how a knowledge of the organisation and expression of an organism's genome can (a) inform our understanding of its relationship with its environment and (b) facilitate advanced approaches to environmental monitoring. Specifically, the module will describe current approaches to genome analysis, and will present examples to illustrate the application of modern genomic and proteomic techniques to aspects of microbial ecology, host/parasite interactions and plant evolution.

Class Hour: To be arranged.

Teaching: Three lectures, one tutorial each week for two weeks and one practical class.

Assessment: Continuous Assessment = 40%, One-and-a-half Hour Examination = 60%

BL5013 Environmental Microbiology and Ecotoxicology

Credits: 10 Semester: 2 (2 weeks)

Programme(s): Optional module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Description: This module will provide a foundation for understanding the principles underpinning environmental microbiology and exotoxicology. Students will be introduced to the physico-chemical parameters which regulate microbial growth in natural environments and the strategies that microorganisms have evolved which enable them to grow in extreme environments. Having gained an overview of the key processes regulating microbial growth, the focus will shift to the consideration of specific case studies. These will include the biogeochemical cycling of nitrogen and sulfur and how an understanding of these processes can be exploited to control eutrophication and bioremediate contaminated soils and water. The final element of this module will be to introduce principles of ecotoxicology and provide an understanding of the origins, significance, and fate and management strategies for the control and removal of environmental pollutants.

Class Hour: To be arranged.

Teaching: Three lectures, one tutorial each week for 2 weeks and one practical class.

Assessment: Continuous Assessment = 40%, One-and-a-half Hour Examination = 60%

BL5015 Essential scientific skills and legislation

Credits: 0 Semester: 1 (1 week)

Programme(s): Compulsory module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Description: The module is designed to provide an introduction to fundamental research requirements including core laboratory and fieldwork skills to enable safe research in both laboratory and the field. Seminars and lectures will cover the University Safety Policy, Risk Assessment, Fire Safety, COSSH Regulations and relevant legislation for performing research in the UK.

Class Hour: To be arranged.

Teaching: One lecture and one seminar.

Assessment: Continuous Assessment = 100%

BL5018 Case Studies in Environmental Biology

Credits: 20 Semester: 1 & 2 (8 weeks)

Programme(s): Compulsory module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Description: Students will study a series of Case Studies in Environmental Biology linked to the specialist knowledge modules studied in the first semester. Each case study will consist of a lecture component linked to a workshop in which a specific scientific topic will be analyzed. The workshops will include use of database design and management, the use of the internet to run desktop experiments using public databases, field studies and laboratory studies where appropriate. Students will prepare talks, posters and internet based presentations as a means of communicating the outcomes of the workshops to the 'general public'. Concurrent to each case study there will be a seminar programme consisting of student presentations critically evaluating specific research papers.

Class Hour: To be arranged.

Teaching: One lecture, one seminar each week for 8 weeks and additional workshops.

Assessment: Continuous Assessment = 100%

BL5019 Research Project

Credits: 55 Semester: 2

Programme(s): Compulsory module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Description: The project will involve the study of a defined problem within the area of environmental biology appropriate to the modules studied by each student. This will involve the design of experiments; the gathering collation and analysis of data; and the discussion of results on their own and in the light of existing literature. The project will be written up in the form of a research dissertation or where appropriate the report may be in the form of a manuscript suitable for submission to a journal.

Teaching: To be arranged.

Assessment: Continuous Assessment = 100%

BL5021 Basic Concepts in Mathematical and Statistical Analysis

Credits: 15 Semester: 1 (3 weeks)

Programme(s): Compulsory module for M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Description: This module will provide students with the basic skills and knowledge required for subsequent compulsory modules on Ecological Dynamics and Statistical Modelling. It will demonstrate the unifying concepts underlying all mathematical and statistical modelling of biological systems, and familiarise students with basic notation, model formulation and probability theory. This will be achieved through a series of tightly linked lectures, practicals, tutorials and workbooks. In the course of the module, students will develop increasingly complex and realistic models which will then be confronted with data from a particular ecological system.

Class Hour: To be arranged.

Teaching: Three lectures, two tutorials and three practical classes.

Assessment: Continuous Assessment = 75%, One-and-a-half Hour Examination = 25%

BL5103 Population Biology of Marine Mammals

Credits: 15 Semester: 2

Programme(s): Compulsory Module for M.Res. in Marine Mammal Science

Description: The module reviews the fundamental concepts of population dynamics (growth, density dependence, stability, population structure) and how these are interpreted in the light of the various life-history strategies adapted by different species of marine mammals. It then examines topics in population genetics, trophic interactions and spatial dynamics. The course also covers practical issues involved in population viability analysis and anticipated future developments in integrative modeling approaches.

Class Hour: To be arranged.

Teaching: Four lectures, one seminar and one practical class each week for three weeks.

Assessment: Continuous Assessment = 50%, One-and-a-half Hour Examination = 50%

BL5104 Conservation and Management of Marine Mammals

Credits: 15 Semester: 2

Programme(s): Compulsory Module for M.Res. in Marine Mammal Science

Description: From the heated debates surrounding whaling to calls for seal culls to protect commercial fish stocks, issues pertaining to marine mammals feature regularly in the public domain and often polarise public opinion. Finding ways to address human-marine mammal conflicts and advise on mitigation have become important tasks for many marine mammal scientists. Through a series of lectures, seminars, debates and workshops, students will explore human-marine mammal interactions to better understand the underlying factors. They will learn to critically evaluate current conservation and management issues and will explore ways in which sound science can contribute to alleviate existing and future conflicts.

Class Hour: To be arranged.

Teaching: Three lectures and two seminars each week for four weeks.

Assessment: Continuous Assessment = 50%, One-and-a-half Hour Examination = 50%

BL5111 Essential Methods in Marine Mammal Science I

Credits: 10 Semester: 1

Anti-requisites: BL5021

Programme(s): Compulsory Module for M.Res. in Marine Mammal Science

Description: This module provides the basic numerical and computational skills necessary for visualizing and summarizing data sets. It is designed as a primer for more advanced courses in statistical modeling and also as an introduction to the computer language R. The examples and computer practicals are motivated from the ecological literature.

Class Hour: To be arranged.

Teaching: Five lectures and two practical classes each week for two weeks, tutorials and one seminar.

Assessment: Continuous Assessment = 50%, One-and-a-half Hour Examination = 50%

BL5112 Essential Methods in Marine Mammal Science II

Credits: 20 Semester: Whole Year

Programme(s): Compulsory Module for M.Res. in Marine Mammal Science

Description: This module will provide an overview of the wide range of methodologies applied in the field of marine mammal science. Lectures will introduce different techniques for sampling individual animals, animal behaviour, abundance and distribution. Students will learn to plan research activities and apply different technical approaches to data collection, processing and analysis. Practicals will provide training in basic principles of GIS application and passive acoustic techniques. During an 8-day optional field trip students will put into practice many of the theoretical aspects and techniques discussed in class.

Class Hour: To be arranged.

Teaching: Four lectures each week for four weeks, two practical classes each week for three weeks and an optional 8-day field trip (during spring break).

Assessment: Continuous Assessment = 100%

BL5121 Current Issues in Marine Mammal Behaviour

Credits: 10 Semester: 2

Prerequisites: BL5201

Programme(s): Optional Module for M.Res. in Marine Mammal Science

Description: Marine mammals are often seen as highly intelligent and complex in their behaviour. This module will investigate such claims by discussing current views and recent advances in the study of marine mammal social behaviour. Each student will present one topic to the class and lead the discussion on it. Topics covered will include brain evolution, dolphin signature whistles, referential communication, cetacean culture, equivalence classes, cooperation and concept formation.

Class Hour: To be arranged.

Teaching: One lecture and nine seminars spread over two weeks

Assessment: Continuous Assessment = 50%, One-and-a-half Hour Examination = 50%

BL5122 Current Issues in Biologging

Credits: 10 Semester: 2

Prerequisites: BL5201

Programme(s): Optional Module for M.Res. in Marine Mammal Science

Description: This module will present an introduction to marine mammal biologging science: the theory and practice of logging and relaying physical and biological data using animal-attached tags. Lectures will cover the technology currently available for measuring animal movements, investigating behaviour, ecology and physiology, some of the problems associated with tag design in terms of how data is stored and transmitted, and problems associated with data analysis and data display.

Class Hour: To be arranged.

Teaching: Three lectures, one seminar and one practical class each week for two weeks.

Assessment: Continuous Assessment = 50%, 1 Hour Examination = 50%

BL5123 Studying Marine Mammals in the Wild: A field course in Iceland

Credits: 10 Semester: before semester 1

Prerequisite: BL1002, BL3319, and BL3318 which is preferred but not essential

Programme(s): Optional module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.or Marine Mammal Science

Description: This field course will teach the fundamentals of a suite of field methodologies used in the study of free-ranging cetaceans (whales and dolphins). Students will stay at housing in Husavik, in an integrated field course setting. During week one, students will receive background lectures on the diverse assemblage of dolphins and whales off Husavik, learn the theory and practice use of each of the different cetacean research methodologies. The methods will include: photo-identification, tracking cetaceans at sea, ship-based survey techniques, behavioural observational techniques, vertical-array acoustics using time-delay methods, towed-array acoustics using beamforming, bottom-mounted hydrophone recording, and shore tracking using a surveyor's transit (theodolite). Experts will present research seminars focusing on how the methodologies are used in cutting-edge research. Master's level students devise and carry out a specific research project using data collected during the fieldwork. M.Res. students will work alongside senior Honours students who will focus on the technical aspects of the methodologies.

Class Hour: Two weeks, full-time

Teaching: Lectures, seminars and practicals

Assessment: Continuous Assessment = 100%

BL5199 Marine Mammal Science Research Project

Credits: 60 Semester: summer

Anti-requisite: BL5110

Programme(s): Compulsory module for M.Res. in Marine Mammal Science.

Description: The research project or dissertation will involve the study of a defined problem within the field of marine mammal science. Students will be required to collate and analyse data and discuss their results in the light of existing literature. In some cases, projects might also involve the design of experiments or the gathering of data. Each project will be written up in the form of a thesis.

Teaching: To be arranged.

Assessment: Research report or Thesis of up to 15,000 words (excluding bibliography) = 100%

BL5201 Biology of Marine Mammals

Credits: 10 Semester: 1

Prerequisites: Undergraduate courses in behaviour, ecology, physiology, zoology or marine science

Programme(s): Compulsory Module for M.Res. in Marine Mammal Science

Description: This module introduces the zoogeography of marine mammals and the morphological, physiological and behavioural adaptations which have enabled this diverse group to successfully colonise all of the world's oceans and some freshwater systems. Students will gain an understanding of the physiological and behavioural complexity underlying movement patterns, diving, foraging, reproduction, and social dynamics of marine mammals across different temporal and spatial scales. Lectures will focus on topical issues and selected examples illustrating and contrasting some of the strategies employed by different marine mammal groups.

Class Hour: To be arranged.

Teaching: Four lectures over four weeks and two tutorials.

Assessment: 2 Hour Examination = 100%

BL5202 Case Studies in Marine Mammal Biology

Credits: 10 Semester: 1

Co-requisite: BL5201

Programme(s): Compulsory Module for M.Res. in Marine Mammal Science

Description: Many of the most topical issues in marine mammal science revolve around ecology and behaviour. In this module, students will explore aspects of diving, foraging, reproduction and social behaviour of marine mammals in greater detail through a series of student-lead seminars, lab practicals and field excursions. Emphasis will be placed on current advances in understanding and research methods. The issues discussed here are often at the base of human-marine mammal conflicts, thus understanding the underlying ecological principles not only provides interesting insights into marine mammal biology but also yields consequences for marine mammal conservation and management.

Class Hour: To be arranged.

Teaching: Two lectures, Five seminars, two practicals and 2 daylong field trips.

Assessment: Continuous Assessment = 100%

BL5301 Marine Systems I

Credits: 15 Semester: 1

Programme(s): Compulsory Module for M.Res. in Marine Systems Science

Description: This module will provide students with an advanced and focused understanding of selected key marine systems. It will introduce the concept of an Earth System and the linkages between biology, chemistry and physics in delivering ecosystem services and maintaining biodiversity. The Current state of knowledge will be synthesized but with emphasis on the speed of change and paradigms in research and management (e.g. Marine Protected Areas). This will provide students with a modern overview of the dynamic processes within and between systems. Together with BL5302 *Marine Systems II*, this module will provide the foundation from which detailed knowledge and skills to measure and interpret system data can develop, together with the use of tools for whole system analysis and management.

Class Hour: To be arranged.

Teaching: Five lectures, one seminar and one practical over three weeks.

Assessment: Continuous Assessment = 50%, 3 Hour Examination = 50%

BL5302 Marine Systems II

Credits: 15 Semester: 2

Programme(s): Compulsory Module for M.Res. in Marine Systems Science

Description: This module will build on BL5301 Marine Systems I to provide students with a broad understanding of key marine systems. It will further enhance the concept of an Earth System and allows more detailed exploration of key systems, contrasting these to highlight significant environmental drivers. Important physical, chemical, biological and geological processes will be studied, alongside key biotic and abiotic interactions. Knowledge will be synthesized to provide students with a critical understanding of dynamic processes within and between systems. Together with BL5301 *Marine Systems I*, this module will provide the foundation from which detailed knowledge and skills to measure and interpret systems data can develop, together with use of tools for whole system analysis and management. This module is taught at the Scottish Association for Marine Science facility at Oban.

Class Hour: To be arranged.

Teaching: Five lectures and one practical each week over three weeks.

Assessment: Continuous Assessment = 50%, 3 Hour Examination = 50%

BL5303 Marine Systems Research Methods

Credits: 15 Semester: 2

Programme(s): Compulsory Module for M.Res. in Marine Systems Science

Description: The study of marine systems requires familiarity with the remote methods of sampling this environment. These methods include the instruments and sampling devices used in physical, geological, biological, chemical and biogeochemical oceanography. The students will use these methods both on ship and in the laboratory, collecting data that they will analyse and disseminate. The module will also include development of scientific writing skills. This module is taught at the Scottish Association for Marine Science facility at Oban.

Class Hour: To be arranged.

Teaching: Six lectures, one tutorial and five practicals in total.

Assessment: Continuous Assessment = 100%

BL5321 Marine Biodiversity and Ecosystem Function

Credits: 15 Semester: 1

Programme(s): Optional Module for M.Res. in Marine Systems Science

Description: This module will provide students with an advanced understanding of biodiversity issues in key marine systems. The current state of knowledge will be synthesized and the most recent theoretical approaches to the measurement of biodiversity, the relationship between biodiversity and ecosystem function examined (The BEF debate). The concept of ecosystem services, over-yielding and habitat connectivity will be addressed. This will provide students with a modern overview of the dynamic interaction between biodiversity and system processes within and between systems.

Class Hour: To be arranged.

Teaching: Five lectures, one seminar and one practical each week over three weeks.

Assessment: Continuous Assessment = 100%

BL5322 Managing Marine Resources for Sustainability

Credits: 30 Semester: 2

Programme(s): Optional Module for M.Res. in Marine Systems Science

Description: This module, through lectures, practical and field/industry visits, will provide students with a broad understanding of issues surrounding use and management of marine resources. Concepts of sustainability and coastal zone management will be explored and examined from the perspective of a variety of stakeholders. Examples of resources extraction and use (e.g. oil/gas, fisheries, renewable energy) will identify key concepts underpinning sustainability and develop student awareness of the related ecological, social, economic and political issues. Underlying principles of conservation and management tools will also be addressed to equip students with critical understanding of system-based approaches to sustainable resource use. This module differs from BL5324 *Organisms to Ecosystems: Anthropogenic Impacts* which takes a more ecological view of the impacts of human activity, including marine resource use, seeking to explore the consequences for biodiversity and ecosystem function. This module is taught at the Scottish Association for Marine Science facility at Oban.

Class Hour: To be arranged.

Teaching: Three to four lectures each week over six weeks, and three practicals and three field trips during the module.

Assessment: Continuous Assessment = 50%, 3 Hour Examination = 50%

BL5323 Advanced Modelling

Credits: 30 Semester: 2

Programme(s): Optional Module for M.Res. in Marine Systems Science

Description: Building on the basic concepts of modelling, and systems modelling taught at St Andrews, this module will teach, through lectures and linked practical sessions, an introduction to physical circulation models, individual and population-based spatial models and ecosystem modeling techniques. Additionally, coupled bio-physical models will be taught. The module will give an overview of the different physical and biological models used in marine systems science, including the assumptions, parameters needed and some examples of these models, together with application of techniques and interpretation of outcomes. This module is taught at the Scottish Association for Marine Science facility at Oban.

Class Hour: To be arranged.

Teaching: Five lectures, one tutorial and five practical classes each week for three weeks.

Assessment: Continuous Assessment = 100%

BL5324 Organisms to Ecosystems: Anthropogenic Impacts

Credits: 30 Semester: 2

Programme(s): Optional Module for M.Res. in Marine Systems Science

Description: Human activities are resulting in a number of physical, chemical, biological and social changes which impact on marine systems, from the organism to the ecosystem level. This elective module will explore the various impacts of these, focusing in particular on the research expertise of SAMS scientists. Physically- driven change will concentrate on Earth's changing climate, ocean acidification and marine sound whilst chemically driven processes will cover metal and oil contamination. Biologically-driven changes will range from aquaculture to marine aliens and finally social change will address the impact of fisheries on the marine system. The module is distinct from BL5322 *Managing Marine Resources for Sustainability* which focuses primarily on the management, legislative and policy issues surrounding resource use rather than the ecological impacts. This module is taught at the Scottish Association for Marine Science facility at Oban.

Class Hour: To be arranged.

Teaching: Three to four lectures and one practical each week over six weeks, and three tutorials over the duration of the module.

Assessment: Continuous Assessment = 50%, 3 Hour Examination = 50%

BL5399 Marine Systems Science Research Project

Credits: 60 Semester: summer

Programme(s): Compulsory module for M.Res. in Marine Systems Science.

Description: The research project or dissertation will involve the study of a defined problem within the field of marine systems science. Students will be required to collate and analyse data and discuss their results in the light of existing literature. In some cases, projects might also involve the design of experiments or the gathering of data. Each project will be written up in the form of a thesis.

Teaching: To be arranged.

Assessment: Research report or Thesis of up to 15,000 words (excluding bibliography) = 100%

ID5005 Enterprise, Creativity and Innovation (10)

Credits: 10 Semester: 1

Programme(s): ID5005 is **Compulsory module** for M.Res in Environmental Biology, M.Res. and in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Optionally available to all Postgraduate Taught Programmes, subject to approval of Course Director/Coordinator within individual Schools.

Description: In this module students will acquire a critical understanding of the concepts and theories that help to understand enterprise and the processes of entrepreneurship and leadership. Through these two elements students will enhance their ability to generate ideas through creative thinking and cognitive-mapping as well as understand the significance and protection of intellectual property rights. This will enable them to better instigate, facilitate and practice in a rigorous approach to entrepreneurship and executive creativity. Teaching media will include formal lectures, case study analysis, team-based workgroups and visiting speakers.

Class Hour: To be arranged.

Teaching: One lecture and one seminar per week over 7 weeks.

Assessment: Continuous Assessment = 100%

ID5011 Geographic Information Systems for Environmental Management

Credits: 15 Semester: 1

Prerequisite: A basic ability in computer skills (Basic word processing, spread sheet analysis) gained through SALTIRE if not demonstrated

Anti-requisite: GE5005, ID5010, ID5012

Programme(s): Either ID5011 or ID5012 is a Compulsory module for Environmental Biology M.Sc., ,M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes, Mathematics & Statistics, Economics, Management and Environmental History Taught Postgraduate Programmes.

Description: This module provides an introduction to Geographic Information systems and their use in environmental problem solving. The module will be taught through a series of lectures, tutorials, laboratory classes and individual projects. The module will be assessed through class exercises and the final, short individual project. Students will be introduced to methods of acquiring, storing, analysing and displaying (2D and 3D) spatial digital data using the ArcGIS data package. An introduction to data manipulation and statistical techniques on a variety of environmental examples will be given. The module is taught within the School of Geography & Geosciences but incorporates datasets and analysis techniques used in earth and environmental science, biology, archaeology, and mathematics.

Class Hour: To be arranged.

Teaching: Lectures, practicals and occasional tutorials.

Assessment: Continuous Assessment = 50%, Short Project = 50%

ID5012 Advanced Geographic Information Systems

Credits: 20 Semester: 1

Prerequisite: A basic ability in computer skills (Basic word processing, spread sheet analysis) gained through SALTIRE if not demonstrated

Anti-requisite: GE5005, ID5010, ID5011

Programme(s): Either ID5011 or ID5012 is a Compulsory module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Description: This module provides an advanced training in Geographic Information Systems (GIS) and their use in environmental problem solving. The module will be taught through a series of lectures, tutorials, laboratory classes with emphasis on a final independent GIS project. The module will begin with an introduction to data storage and manipulation, basic analysis of 2D and 3D spatial digital data and methods of display and will conclude with database design and more advanced data analysis using ArcGIS. Assessment will be based on the class exercises and the final project. The module is taught within the School of Geography & Geosciences but incorporates datasets and analysis techniques used in earth science, biology, economics and management and mathematics.

Class Hour: To be arranged.

Teaching: Lectures, practicals and occasional tutorials.

Assessment: Continuous Assessment = 40%, Individual Project = 60%

MT5751 Estimating Animal Abundance

Credits: 10 Semester: 2 (2 weeks)

Programme(s): Optional module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences and M.Res. in Marine Mammal Science Postgraduate Taught Programmes.

Description: The module will introduce students to the main types of survey method for wildlife populations. It will cover simple methods in some detail and provide students with a conceptual framework for building understanding of more advanced methods. By the end of the course, students will be able to identify an appropriate assessment method for a given population, be able to design a simple survey to assess the population, and perform simple analyses of survey data. Students will get experience in using the methods via computer practical sessions involving design and analyses of surveys conducted by computer simulation.

Class Hour: To be arranged.

Teaching: Four lectures, one tutorial and two practical classes each week for 2 weeks.

Assessment: Continuous Assessment = 40%, 2 Hour Examination = 60%

MT5752 Modelling Ecological Dynamics

Credits: 20 Semester: 2 (4 weeks)

Prerequisite: BL5021 or substantial quantitative training

Programme(s): Compulsory module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Description: This module is designed to provide practical training in the construction and use of mathematical models of ecological dynamic systems. The module will start by covering basic dynamical concepts and mathematical tools, and will then cover modelling of individuals, single species populations, interacting populations and ecosystems. At all stages students will be expected to build and analyse models, with a combination of pencil and paper and computer software.

Class Hour: To be arranged.

Teaching: Four lectures, one tutorial and three practicals each week for 4 weeks.

Assessment: Continuous Assessment = 40%, 2 Hour Examination = 60%

MT5753 Statistical Modelling

Credits: 20 Semester: 1 (4 weeks)

Programme(s): Compulsory module for M.Res. in Environmental Biology and M.Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences and M.Res. in Marine Mammal Science Postgraduate Taught Programmes.

Description: This module will introduce the main ideas of linear and generalised linear statistical modelling and will provide training in applied statistical modelling. The module structure is as follows: what statistical models are and what they are for; distributions, point and interval estimation and hypothesis testing; simple linear regression models for normal data; multiple regression; multiple regression with qualitative explanatory variables; less linear models for non-normal data; generalized linear models. Lectures will be built around the book "An Introduction to Statistical Modelling" (Krzanowski, 1998), which closely matches what we believe to be an ideal course structure.

Class Hour: To be arranged.

Teaching: Four lectures, one tutorial and three practicals each week for 4 weeks.

Assessment: Continuous Assessment = 40%, 2 Hour Examination = 60%

MT5754 Mini Project 1

Credits: 20 Semester: 2 (4 weeks)

Prerequisite: MT5752 or the equivalent course outwith St Andrews

Programme(s): Optional module for M. Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Description: This module is an alternative to students who have already studied MT5752 (Modelling Ecological Dynamics) as part of their undergraduate training or have gained an equivalent level of training out-with St Andrews. The module will allow the student to apply the skills and knowledge previously acquired in a short mini project appropriate to the taught module. The mini project will be designed to have the same workload as the equivalent taught module.

Class Hour: To be arranged.

Teaching: Individual projects planned with the appropriate Module Co-ordinator and meetings arranged as required.

Assessment: Continuous Assessment = 100%

MT5755 Mini Project 2

Credits: 20 Semester: 1 (4 weeks)

Prerequisite: MT5753 or the equivalent course outwith St Andrews

Programme(s): Optional module for M. Res. in Environmental Biology Conversion for Mathematical, Physical and Molecular Sciences Postgraduate Taught Programmes.

Description: This module is an alternative to students who have already studied MT5753 (Statistical Modelling) as part of their undergraduate training or have gained an equivalent level of training outwith St Andrews. The module will allow the student to apply the skills and knowledge previously acquired in a short mini project appropriate to the taught module. The mini project will be designed to have the same workload as the equivalent taught module.

Class Hour: To be arranged.

Teaching: Individual projects planned with the appropriate Module Co-ordinator and meetings arranged as required.

Assessment: Continuous Assessment = 100%