MSc/PgD
Quantitative Methods in Biodiversity, Conservation & Epidemiology (QMBCE)

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Introduction to the Programmes:
There is a growing interest in the inter-related fields of biodiversity, animal ecology, conservation biology, epidemiology, applied behaviour and animal welfare. Despite overlap between these subject areas, there is very little opportunity in current undergraduate programmes to acquire the range of sophisticated practical skills required in the modern practice of these disciplines. There are also few postgraduate opportunities to combine skills across these subject areas. At a fundamental level many of the core skills are shared between these areas and these MSc programmes are designed to exploit this by providing the opportunity for motivated students to gain the relevant skill sets over the course of a number of short courses, which will allow the student flexibility to design the most appropriate combination of skills and experiences relevant to their future career paths.

These programmes are hosted by the Institute of Biodiversity, Animal Health and Comparative Medicine (IBAHCM), which includes top quality researchers who focus on combining ecology and evolution with more applied problems in animal health and welfare. This direct linking of veterinarians and life sciences is rare but offers unique opportunities to provide training that spans both fundamental and applied research. These courses encompass key skills in monitoring and assessing biodiversity critical for understanding the impacts of environmental change; quantitative analyses of ecological and epidemiological data critical for animal health and conservation; and ethics and legislative policy critical for promoting humane treatment of both captive and wild animals. The uniqueness of this programme is the opportunity to gain core skills and knowledge across a wide range of subjects, which will enhance future career opportunities, including entrance into competitive PhD programmes. For example, it is rare for students in animal welfare to gain extensive quantitative skills, even though this can be critical for designing experiments that meet the criteria of the "three R's" (reduce, refine, replace) in animal-based research. Similarly, there are identification-based programmes offered elsewhere, but no others combine practical field skills with molecular techniques, advanced informatics for assessing biodiversity based on molecular markers, and advanced statistics. Other courses in epidemiology are rarely ecologically focused; the specialty in IBAHCM is in understanding disease ecology, in the context of both animal conservation and implications for both human and animal public health.

The programme is divided into two specialties: Quantitative Methods in Biodiversity, Conservation and Epidemiology (QMBCE) and Animal Welfare Science, Ethics & Law (AWSEL). One of the main benefits of the MSc programme is its emphasis on flexibility, practical training and timeliness of topics learned. Throughout the programme, courses will be taught by research-active staff and will involve the latest approaches in quantitative methods (mostly using the programming environment R), sequence analysis (including uses of new high throughput sequencing technologies), practical approaches to assessing biodiversity, and legislation and ethics associated with the use of animals in research. The emphasis for each is on 'hands-on' skills training; both will include a combination of lectures to set the theoretical background and computer, laboratory, or field-based practicals to apply skills learned. After a suite of core courses in the first term designed to improve generic or subject-related skills, students can choose from a range of options in the 2nd term and will complete an independent research project in the 3rd term.

Opportunities for independent research projects include use of: the University field station on Loch Lomond (Scottish Centre for Ecology and the Natural Environment, SCENE) for freshwater or terrestrial-based projects; Millport field station on the Isle of Cumbria for marine projects,;or Cochno farm in Glasgow for research based on farm animals; and the Manu Learning Centre Amazaonian research station in southeastern Peru for tropical ecology and biodiversity projects. In addition, opportunities will be sought for students to obtain placements in zoos (for welfare-based research) or environmental consulting firms (for biodiversity assessment-based research).

Quantitative Methods in Biodiversity, Conservation & Epidemiology (QMBCE)
Course Coordinator: Dr. Roman Biek (roman.biek@glasgow.ac.uk): Quantitative approaches in biodiversity measurement and informatics, ecology, epidemiology and conservation biology, covering such topics such as conservation genetics; public, veterinary and ecosystem health; wildlife disease ecology; emerging and zoonotic diseases; sampling and survey methods for freshwater, terrestrial and marine environments; invertebrate and vertebrate identification; the impact of environmental change at local and global scales; quantitative approaches for measuring biodiversity; phyloinformatics; molecular methods used in DNA barcoding; advanced statistics and mathematical modelling. The course is designed to integrate practical field and computer-based skills with molecular techniques and advanced analytical methods. Emphasis will be both on fundamental and applied research problems.

Animal Welfare Science, Ethics and Law (AWSEL)
Course Coordinator: Dr. Ruedi Nager (ruedi.nager@glasgow.ac.uk): Animal welfare science and ethics is an expanding topic of international concern. It aims to improve our knowledge and understanding of animals' needs, which is required to provide a high standard of care to animals in farms, zoos, research laboratories and in the wild. The course will cover topics on ethics, welfare, legislation and will provide knowledge and practical experience needed to work with animals in research, zoos or other contexts. Albeit the course will cover farm, zoo, wild, and companion animals, a particular emphasis will be on laboratory animals that are often neglected in similar courses.

Course Structure: Each term consists of 60 credits. Although there are some different core courses for the two specialisations, the fundamental structure is the same. Term 1 consists of a prescribed set of courses. Term 2 has some core courses (10 credits for QMBCE; 20 credits for AWSEL); the remaining credits can be chosen from the list of options spanning the two specialisations. Term 3 is an independent research project. Details of the programme for each specialisation are provided on the following pages—the options are the same, it is just the core courses that differ. You will require a laptop computer for most of the modules. There is a strong emphasis on in-course assignments to develop practical skills, keeping a detailed logbook of skills and knowledge learned, and written reports that will require incorporating key research skills learned across modules. Some courses will also involve fieldwork and offsite visits. Students wishing to exit with a PGdip or who do not meet the minimum standard for continuing through the MSc, will finish after term 2.

Assessment Methods: Students will demonstrate that they have grasped the principles of the subject area and can apply it through consolidation of the methods, concepts and broader context of the discipline in the form of independent assignments, essays and reports comprising 50-100% of the mark, depending on the course). Some courses will be partly assessed on take-home problem-based assignments to demonstrate learned principles, including short answer questions for critical discussion (25-50% of mark, depending on the course). Courses with laboratory and tutorial components will also include assessment of participation and competencies learned, based on reflective portfolios in the form of a logbook (20-50% of mark, depending on the course). For students completing the full MSc (i.e., including an independent project), 50% of the mark will be based on the project, with the remainder based on assessment of performance and diligence in carrying out the project (25%) and on a written project proposal (25%).

Students will be permitted to progress to preparation of the research project only if he or she has obtained an average aggregation score of 12 (equivalent to C3) in 120 credits with at least 75% of the credits at Grade D3 or better and all credits at Grade F or above. Students can exit with a Postgraduate Diploma if they achieve an average aggregation score of 9 (equivalent to D3) or above in 120 credits, with not less than 80 of these credits at Grade D or above. Students may exit with a Postgraduate Certificate with an average aggregation score of 9 (equivalent to D3) or above in 60 credits, with not less than 40 of these credits at Grade D or above.

Course Summary: Quantitative Methods in Biodiversity, Conservation & Epidemiology
A total of 180 credits are required, with 50 flexible credits in the 2nd term. For options, please email the relevant course coordinator (see course details below) as well as registering on My Campus.

TITLE	CODE	CREDITS	ASSESSMENT (%)
Term 1: Core Courses			
Key research skills (Scientific writing, Introduction to R, Advanced linear models, Experimental design & power analysis)	BIOL5126P	40	Scientific report – 50; Logbook – 30; Assignments – 20
Measuring biodiversity & abundance	BIOL5129	20	Assignments – 50; Logbook – 50
Term 2: Core Courses			
Programming in R	BIOL5133	10	Assignments – 50; Logbook – 50
Term 2: Optional Courses			
Infectious disease ecology & the dynamics of emerging disease	BIOL5123	10	Assignment – 70; Logbook 30
Single-species population models	BIOL5135	10	Assignment – 50; Logbook – 50
Multi-species models	BIOL5131	10	Assignment – 50; Logbook – 50
Spatial and network processes in ecology & epidemiology	BIOL5136	10	Assignment – 70; Logbook – 30
Introduction to Bayesian statistics	BIOL5124	10	Assignment – 50; Logbook – 50
Freshwater sampling techniques	BIOL5122	10	Assignment – 50; Logbook – 50
Invertebrate identification	BIOL5125	10	Class test – 40; Assignment – 40; Logbook – 20
Vertebrate identification	BIOL5137	10	Class test – 40; Assignment – 40; Logbook - 20
Molecular analyses for DNA barcoding and biodiversity measurement	BIOL5130	10	Assignment – 70; Logbook - 30
Phyloinformatics	BIOL5132	10	Assignment – 75*;* Logbook – 25
Conservation genetics & phylodynamics	BIOL5119	10	Essay – 75*;* Logbook – 25
Animal welfare science	BIOL5115	10	Essay – 75; Tutorial/site visit paper – 25
Legislation related to animal welfare	BIOL5127	10	Assignment – 75; Tutorial paper – 25
Assessment of physiological state	BIOL5116	10	Essay - 100
Biology of suffering	BIOL5117	10	Essay – 75; Tutorial paper - 25
Care of captive animals	BIOL5118	10	Report – 100
Enrichment of animals in captive environments	BIOL5120	10	Assignment – 100
Term 3: Core MSc Component			
Research project	BIOL5134	60	Research proposal – 25; Experimental/analytical parts of project – 25; 10,000 word project report - 50

Course Summary: Animal Welfare Science, Ethics & Law
A total of 180 credits are required, with 40 flexible credits in the 2nd term. For options, please email the relevant course coordinator (see course details below) as well as registering using MyCampus.

TITLE	CODE	CREDITS	ASSESSMENT (%)
Term 1: Core Courses			
Key research skills (Scientific writing, Introduction to R, Advanced Linear Models, Experimental design & power analysis)	BIOL5126P	40	Scientific report – 40; Logbook – 20; Assignments – 40
Animal ethics	BIOL5114	20	Presentation – 35; Written article – 35; Logbook – 30
Term 2: Core Courses			
Animal welfare science	BIOL5115	10	Essay – 75; Tutorial/site visit paper – 25
Legislation related to animal welfare	BIOL5127	10	Assignment – 75; Tutorial paper – 25
Term 2: Optional Courses			
Assessment of physiological state	BIOL5116	10	Essay - 100
Biology of suffering	BIOL5117	10	Essay – 75; Tutorial paper - 25
Care of captive animals	BIOL5118	10	Report – 100
Enrichment of animals in captive environments	BIOL5120	10	Assignment – 100
Programming in R	BIOL5133	10	Assignments – 50; Logbook – 50
Freshwater sampling techniques	BIOL5122	10	Essay – 40; Assignment – 40; Logbook – 20
Invertebrate identification	BIOL5125	10	Class test – 40; Assignment – 40; Logbook – 20
Vertebrate identification	BIOL5137	10	Class test – 40; Assignment – 40; Logbook - 20
Molecular analyses for DNA barcoding and biodiversity measurement	BIOL5130	10	Assignment – 70; Logbook - 30
Phyloinformatics	BIOL5132	10	Assignment – 80*;* Logbook – 20
Conservation genetics & phylodynamics	BIOL5119	10	Essay – 75*;* Logbook – 25
Infectious disease ecology & the dynamics of emerging disease	BIOL5123	10	Assignment – 70; Logbook 30
Single-species population models	BIOL5135	10	Assignment – 50; Logbook – 50
Multi-species models	BIOL5131	10	Assignment – 50; Logbook – 50
Spatial and network processes in ecology & epidemiology	BIOL5136	10	Assignment – 70; Logbook – 30
Introduction to Bayesian statistics	BIOL5124	10	Assignment – 50; Logbook – 50
Term 3: Core MSc Component			
Research project	BIOL5134	60	Research proposal – 25; Experimental/analytical parts of project – 25; 10,000 word project report - 50

Detailed Course Descriptions

Term 1: Core Courses
Key Research Skills (required for all; 40 credits)

Course Coordinator: Prof. Barbara Mable (Barbara.mable@glasgow.ac.uk)

Additional Instructors: Prof. Daniel Haydon (Daniel.haydon@glasgow.ac.uk), Dr. Roman Biek (roman.biek@glasgow.ac.uk)

Course Aims: The aims of this course are to ensure that all students enrolled in the MSc/PGdip and MRES programmes receive advanced and evidence-based training in the key skills essential for any modern ecology/evolution-based research career and for the courses that they will take later in the programme. All sessions will involve practical hands-on training, as well as lectures introducing the concepts. Sessions are divided broadly into: 1) Scientific Communication and 2) R & Statistics (including Introduction to the Programming Environment R, Advanced Statistics, and Experimental Design & Power Analysis). Students will also attend lectures for an introductory statistics course to make sure that all are familiar with a general linear models approach to statistical analysis.

Intended Learning Outcomes
By the end of this course students will be able to:

- Understand and apply consistent rules in grammatical structure and punctuation
- Develop effective strategies for writing well-structured and critical essays, grant proposals and scientific reports that set the context of the objectives based on information synthesized from the primary literature, clearly describe the methodology (including quantitative analyses), present results in an easily understandable format, and discuss results in the context of the broader body of literature in the relevant scientific field
- Download and install R, along with packages and libraries relevant to the analysis of biological data, import data, use objects, and plot data, acquiring technical help as required from literature and online sources
- Discuss critically appropriate uses of some of the key features of R, including random number generation, data manipulation, input output, and basic descriptive statistics.
- Use R to implement a wide range of generalized linear mixed models, and discuss critically the justification for choice of models for particular scientific questions
- Organize data in a form appropriate for further analysis
- Use the evidence base to formulate null and alternate hypotheses associated with particular statistical tests
- Critically interpret the output from these analyses, test identified hypotheses and discuss the results in the context of the primary literature
- Recognize and critically assess the underlying models associated with these statistical analyses
- Identify and interpret statistical interactions and random effects in the context of real data
- Conduct a full range of diagnostic tests to ensure the data complies with assumptions of the methodology
- Take an evidence-based approach to designing effective experiments (and other data collection exercises)
- Critically evaluate other scientists' experimental designs
- Critically discuss the key concepts in experimental design by integrating knowledge obtained from private study and from theories provided in class
- Implement knowledge learned in the analysis of experimental data and scientific writing to write a report based on learning integrated across all four core modules, using real data to generate a specific hypothesis to be tested in the context of the existing background in the primary literature, describe the specific methods used to analyse the data, describe and interpret the results based on the evidence base and write a critical discussion that sets the results in the context of the primary literature.

Assessment: The "logbook" is a means of assessing student participation and understanding of the course content, and will make up 20% of the mark: for the scientific communications part of the course, students will write a reflective essay that details what was learned throughout the course (10%) and for the R & Statistics component, this will be assessed through annotations on the R-scripts that will be the basis of each exercise. In-class assignments will comprise 40% of the mark and will be divided equally between the Scientific Communications and R & Statitistics components. The remaining 40% of the mark will be based on a scientific report (3000-5000 words) in the form of a publishable journal article that will integrate skills across all topics. Specifically, students will be provided with a dataset and a brief description of the motivation for why the data were collected. They will need to analyse the data using the skills learned in the introduction to R, Experimental design, and Advanced Statistics components and write up the report as a full scientific paper.

Measuring Biodiversity & Abundance (required for QMBCE; 20 credits)

Course Coordinator: Dr. Ross MacLeod (ross.macleod@glasgow.ac.uk)

Additional Instructors: Dr. Grant Hopcraft (grant.hopcraft@glasgow.ac.uk), Dr. Stewart White (stewart.white@glasgow.ac.uk), Dr. Colin MacLeod

Course Aims: The aim of the course is to provide students with evidence-based core training in the use of a wide range of sampling techniques currently available for invertebrate and vertebrate organisms in a terrestrial environment, as well as to explore techniques used for the quantification of biodiversity and the measurement of abundance.

Intended Learning Outcomes

By the end of this course students will be able to critically discuss with respect to the evidence base:

- The strengths and weakness of different sampling methods and associated methods for estimating abundance
- Which techniques are most appropriate under particular conditions and to target particular taxonomic groups
- The power of biodiversity sampling and abundance measurement as a means of monitoring environmental quality and be able to describe the limitations and benefits of the approach

In addition, the students will:

- Devise a biodiversity sampling or abundance monitoring programme aimed at solving a specific biodiversity monitoring challenge

Assessment: Students will write a reflective portfolio in the form of a logbook, reflecting participation in tutorials and laboratories (50%). Students will integrate practical and lecture work with independent reading in assignments designed to discuss critically how they would tackle a specific biodiversity monitoring challenge that involves quantifying biodiversity and evaluating which measures of diversity or abundance are most appropriate for the taxonomic group, habitat type and sampling circumstances (50%).

Animal Ethics (required for AWSEL; 20 credits)

Course Coordinators: Dr. Ruedi Nager (ruedi.nager@glasgow.ac.uk), Dr. Dorothy McKeegan (dorothy.mckeegan@glasgow.ac.uk)

Course Aims: The aim of the course is to provide students with a critical awareness of the principles of relevant ethical frameworks and how this relates to legal considerations and different forms of human use of animals.

Intended Learning Outcomes
By the end of this course students will be able to:

- Recognise, evaluate and critically discuss the whole range of relevant ethical frameworks and develop a critical understanding of the aims, approaches and limitations of welfare research and its contribution to legislative change
- Discuss critically with reference to the primary literature the tools to be used to recognise and reflect on ethical questions relating to the different human uses of animals and practices in ethical reasoning and the main controversial issues in animal ethics
- Critically discuss, evaluate and synthesise welfare and ethical issues relating to different forms of human use of animals, contrasting our treatment of animals in different contexts where appropriate
- Critically analyse ethical dilemmas, employing ethical reasoning and applying ethical principles in the context of relevant case examples

Assessment: Students will write a reflective portfolio in the form of a logbook to demonstrate their changing awareness throughout the course of the tutorial discussions (30%), as well as an oral presentation and subsequent written defence (2000-3000 words) of the view expressed in that presentation that critically reflects on controversial issues concerning different uses of human use of animals (where presentation and defence of the view expressed in the discussion contribute 35% each).

Term 2: Core Courses (all 10 credits)

Programming in R (required for QMBCE; option for AWSEL)

Course Coordinator: Dr. Richard Reeve (richard.reeve@glasgow.ac.uk)

Course Aims: The aim of this course is to provide hands-on training in programming in the R environment, and teach students to use the data structures and libraries provided by the R project appropriately to solve problems.

Intended Learning Outcomes
With reference to the evidence base, by the end of this course students will be able to:

- Use appropriate data structures to retrieve and store information in R
- Select and justify the appropriate loops and program structures in R when solving a problem
- Use comments appropriately to explain program structure and design
- Find appropriate R libraries to aid in the solution of more complex problems
- Design simple computer programs to solve specified problems
- Write programs in R

Assessment: Students will write a reflective portfolio in the form of a logbook, reflecting participation and competencies learned in practical computer laboratories (50%). The remaining 50% will be based on an independent assignment that will require integration of the evidence-based knowledge and skills learned, involving direct application of programming skills obtained.

Animal Welfare Science (core for AWSEL; option for QMBCE)

Course Coordinators: Dr. Ruedi Nager (ruedi.nager@glasgow.ac.uk), Dr. Dorothy McKeegan (dorothy.mckeegan@glasgow.ac.uk)

Course Aims: The aim of the course is to provide students with an evidence-based critical and detailed understanding of welfare assessment methodologies and practical experience of how welfare issues are addressed at sites that keep animals for different forms of human use, including research on wild animals.

Intended Learning Outcomes
By the end of this course students will be able to critically evaluate with respect to literature:

- The complexity of the concept of welfare and critically analyse the application of different approaches to welfare assessment
- Approaches for analysing and evaluating identification of appropriate methods that can be used to assess specific welfare issues
- The latest issues and outcomes of research into animal welfare issues

In addition, they will:

- Obtain practical, first-hand experience of welfare issues in different forms of human use of animals and be able to have an informed discussion and make critical judgement on practical welfare issues
- Apply critical analysis, evaluation and synthesis of principles of welfare to work with wild animals

Assessment: Students will write a reflective summary (1000 words) of what was learned in tutorials and site visits (25%), and will write an essay (3000-5000 words) on welfare science (75%).

Legislation Related to Animal Welfare (core for AWSEL; option for QMBCE)

Course Coordinator: Dr. Ruedi Nager (ruedi.nager@glasgow.ac.uk)

Course Aims: The aim of the course is to provide students with a rigorous evidence-based understanding of the different pieces of legislation underlying the use of animals in scientific research, in zoos and in farms.

Intended Learning Outcomes
By the end of this course students will be able to critically discuss with respect to the primary literature:

- Legislations concerning keeping animals in captivity in the UK and a critical understanding of the UK legislative frameworks protecting animals in different contexts
- Key legislation relating to animal welfare in farm, laboratory and zoo
- UK legislation on the different forms of human use of animals and critically reflect on and debate analytically and critically on controversial issues related to the use of animals.
- How legislation is underpinned by ethical principles and results of current research in welfare science

Assessment: Students will write a short reflective summary of discussions from the tutorials (1000 words), which will comprise 25% of the mark. The remaining 75% will be based on a debate on legislation of animal use where each student will be assigned a specific role. Assessment will be based on a reflective portfolio that the students will write (2000-3000 words), describing their views and rationale based on their reading of the primary literature before the debate, followed be a comparison of how their views were influenced during the debate.

Term 2: Optional Courses (listed alphabetically)

Assessment of Physiological State

Course Coordinator: Dr. Ruedi Nager (ruedi.nager@glasgow.ac.uk)

Course Aims: The aim of the course is to provide students with an evidence-based understanding of methods and techniques used to assess physiological state of wild animals and provide them with the competence to identify the health state of wild animal and to respond appropriately to this.

Intended Learning Outcomes
By the end of this course students will be able to:

- Comprehensively and critically discuss the relevance of concepts from behaviour and ecology to ethics and welfare with reference to the key literature
- Critically discuss the concept of optimality models and cost-benefit analysis with respect to resource acquisition, critical awareness of techniques to study resource acquisition and critically analyse how this influences the choice of habitats
- Critically analyse, evaluate and synthesise methodologies and techniques that can be used to monitor physiological, reproductive and health state of wild animals
- Demonstrate critical understanding of the evidence for how different stages in the life of animals are linked within and across generations in wild animals
- Critically analyse and evaluate the principles of signalling physiological state of an individual and how reproductive decisions can be state-dependent
- Critically review the relevant literature on how demography and genetics contribute to the well-being of individuals and populations

Assessment: Students will be assessed on an essay where they will have to discuss critically the topics learnt in this course and how this relates to the welfare assessment of wild animals and the ethics and legal issues of working with wild animals (100% of mark). The approximate word count of the essay should be 3000-5000 words.

Biology of Suffering

Course Coordinator: *Dr. Ruedi Nager (ruedi.nager@glasgow.ac.uk)*

Course Aims: The aim of the course is to provide students with an advanced understanding of issues on consciousness, sentience and suffering in animals and how this relates to ethical and legal considerations.

Intended Learning Outcomes
By the end of this course students will be able to:

- Discuss critically the issues involved with welfare research, the challenges faced in assessing animal subjective states, and the strengths and weaknesses of different approaches
- Discuss critically the physiological basis of the stress response, the latest methodological developments on how to measure stress, and current understanding of animal cognition and consciousness; and how these can inform welfare research
- Demonstrate detailed knowledge and critical understanding of the physiological basis of pain, discuss its evolution in the animal kingdom, and be informed by the developments at the forefront of pain research
- Apply knowledge and synthetic understanding of pain and stress to critically reflect on ethical issues and legislation
- Discuss critically the principles and concepts of disturbance and a critical awareness of its impacts on captive and wild animals

Assessment: Students will prepare a paper (1000-2000 words) where they critically discuss their views prior to the tutorial and how they were adapted during the tutorial, with reference to the literature, which will contribute 25% of the total mark. The remaining 75% will be based on an essay of 3000-5000 words that critically reflects (through a comprehensive assessment of the relevant body of literature) on topical issues in biology of suffering and relates these to ethical and legal considerations.

Care of Captive Animals

Course Coordinator: *Dr. Ruedi Nager (ruedi.nager@glasgow.ac.uk)*

Course Aims: The aim of the course is to provide students with a critical awareness of issues relating to care of captive animals and relate these to legislation and welfare science.

Intended Learning Outcomes
By the end of this course students will be able to critically describe with respect to the primary literature:

- The theories and principles underlying the design of animal husbandry approaches
- The importance of nutrition and apply these principles to the design of diets for captive animals
- The techniques available to assess the health status of captive animals
- The concept of behavioural needs, critical analysis of how this can be met in captive situations, as well as the welfare consequences

Assessment: A written report aimed at designing an evidence-based protocol to keep a certain species and justify the proposed husbandry protocol and diet (3000-5000 words).

Conservation Genetics & Phylodynamics

Course Coordinator*:* Dr. Roman Biek (roman.biek@glasgow.ac.uk)

Course Aims: To provide students with the conceptual background and hands-on training required for analysing and interpreting genetic data to answer applied questions in ecology, conservation biology and epidemiology, through the use of relevant specialised computer software and critical evaluation of the scientific literature.

Intended Learning Outcomes
By the end of this course students will be able to:

- Critically discuss with respect to the primary literature the use of various types of genetic data used in molecular ecology and epidemiology and their suitability for addressing specific research questions
- Conduct basic analyses on such data using contemporary software (including the program BEAST and others) and diagnose and troubleshoot problems encountered during analysis
- Critically interpret and synthesise results of these analyses and make specific management recommendations on their basis with reference to the evidence base

Assessment: Students will write a reflective portfolio in the form of a logbook, reflecting concepts and practice gained during laboratories (25%). The remaining 75% will be based on an essay focused on a particular applied research problem in ecology, conservation or epidemiology (3000-5000 words).

Enrichment of Animals in Captive Environments

Course Coordinator: Dr. Ruedi Nager (ruedi.nager@glasgow.ac.uk)

Course Aims: The aim of the course is to provide students with the underlying principles that will guide enrichment and the design of enclosures and encourages students to creatively think about their own solution to welfare issues.

Intended Learning Outcomes
By the end of this course students will be able to discuss critically with respect to the primary literature:

- The relevant key enrichment pathways and choice of enrichment options appropriate to a given problem
- How enrichment and enclosure design impact on the animal's welfare
- Key issues in environmental enrichment for animal welfare, with respect to home office and EU requirements
- Latest developments in research on environmental enrichment
- Principles of welfare in the design of novel animal enclosures/cages/animal rooms

Assessment: Students will write an evidence based assignment (100%) in which they will design of a novel animal enclosure/cage/ laboratory room, critically reflecting on different possibilities and practicalities in a real life situation and justifying the chosen solution in terms of ethical, legal and welfare considerations (3000-5000 words).

Freshwater Sampling Techniques

Course Coordinator: Prof. Colin Adams (colin.adams@glasgow.ac.uk)

Course Aims: The aim of the course is to provide students with core hands-on training in the use of a wide range of sampling techniques currently available for invertebrate and vertebrate organisms in a freshwater environment.

Intended Learning Outcomes
By the end of this course students will be able to discuss with reference to the evidence base:

- The strengths and weakness of different sampling methods
- The power of biodiversity sampling as a means of monitoring environmental quality and be able to describe the limitations and benefits of the approach

In addition, students will be able to:

- Use their practical experience in the use of various methods and decide which are most appropriate under particular conditions and to target particular taxonomic groups
- Identify the diversity of species groups present and apply appropriate measures of biodiversity for the particular type of sample obtained
- Devise and deploy an independent research project aimed at comparing the efficiency of alternative techniques, both qualitatively and quantitatively, and comparing levels of biodiversity in different habitat types

Assessment: Students will write a reflective portfolio in the form of a logbook, reflecting participation in tutorials and laboratories (20%). Students will write an essay (2000-3000 words) that outlines the various strengths and weaknesses of the range of sampling methods applied and the utility of using biodiversity measures to assess environmental quality (40%). Students will integrate and apply the knowledge obtained in the preparation of an independent assignment (2000-3000 words) that will involve quantifying biodiversity in a sample obtained and evaluating which measures of diversity are most appropriate for the taxonomic groups identified and for the particular habitat type sampled (40%).

Infectious Disease Ecology & the Dynamics of Emerging Disease

Course Coordinator: Dr. Louise Matthews (louise.matthews@glasgow.ac.uk)

Course Aims: The aim of this course is to equip students with the mathematical and programming skills and theoretical background to be able to create simple epidemiological models, to interpret their outputs and to be able to critically evaluate published papers on infectious disease dynamics.

Intended Learning Outcomes
By the end of this course students will be able to critically discuss with respect to literature and theoretical background:

- The value of currently used standard epidemiological models
- The distinction between: frequency and density-dependent transmission; micro and macroparasite models
- The concept of herd immunity
- The principles behind standard vaccination strategies
- The distinction between and appropriate use of stochastic and deterministic formulations
- The definition and conceptual framework for the basic reproduction number
- The concept of critical community size
- The context for use of metapopulation models
- Impacts of host heterogeneity on infection dynamics
- The use of standard model types in the epidemiological literature

In addition, they will be able to:

- Program standard epidemiological models in R and interpret outputs
- Calculate the basic reproduction number for simple epidemiological models
- Identify and interpret equilibria in standard epidemiological models
- Generate a mathematical description of an infection dynamics model for a problem of their own choice

Assessment: Students will write a reflective portfolio in the form of a logbook, reflecting participation and competency in practical laboratories (30%). The remaining 70% will be an independent and evidence-based assignment that will require integration of the knowledge and skills learned in this module (3000-5000 words)

Introduction to Bayesian Statistics

Course Coordinator: Prof. Jason Matthiopoulos (Jason.matthiopoulous@glasgow.ac.uk)

Course Aims: The aim of the course is to provide the student with an evidence-based founding in the basic theory and practice of Bayesian statistics.

Intended Learning Outcomes
By the end of this course students will be able to critically discuss with reference to theory and practice:

- The key differences between a Bayesian and frequentist approach
- How prior information is used in a Bayesian approach
- The concept of Markov Chain Monte Carlo techniques
- The distinction between Metropolis-Hastings and Gibbs sampling

In addition, they will be able to:

- Write simple programs in WinBugs or JAGs
- Specify and discuss critically the appropriate use of both informative and ‘uninformative’ priors
- Identify when a model has converged
- Conduct model selection using DIC

Assessment: Students will write a reflective portfolio in the form of a logbook, reflecting participation and competencies learned in laboratories (50%). The remaining 50% will be a take-home problem-based assignment that will require integration of the knowledge and skills learned in this module, as well as short answer critical discussion of the key concepts.

Invertebrate Identification

Course Coordinator: Dr. Stewart White (stewart.white@glasgow.ac.uk)

Course Aims: The aim of this course is to provide students with in depth hands-on training to enable them to identify key vertebrate groups, using field guides, identification keys, and vocalizations, as required for assessment of biodiversity.

Intended Learning Outcomes

By the end of this course students will be able to take an evidence-based approach to:

- Identify species from key invertebrate groups, to the lowest taxonomic level possible for that group
- Use taxonomic keys and the principles behind them so that they can understand and implement the use of novel keys for groups that have not been studied directly in this course
- Understand and calculate biodiversity based on a range of indices and choose those most relevant to the taxa under study
- Consolidate the methodologies learned, in terms of an in-class laboratory test to evaluate their ability to use keys
- Devise and deploy an independent research assignment aimed at comparing trap efficiency, both qualitatively and quantitatively, and comparing levels of biodiversity in different habitat types in terms of species richness and abundance, which will require integration of knowledge learned in the core course Measuring Biodiversity and Abundance in the autumn term

Assessment: Students will prepare a reflective portfolio in the form of a logbook, reflecting participation in tutorials and laboratories (20%), as well as demonstrating proficiency in identification through in-class tests (40%). Students will integrate knowledge learned in the preparation of an independent and evidence based assignment that will involve quantifying biodiversity in a sample obtained from either an aquatic or the terrestrial sampling course, and evaluating which measures of diversity are most appropriate for the taxonomic groups identified, for the particular habitat type sampled, as well as assessing which trapping techniques learned during the sampling modules are most efficient both qualitatively and quantitatively (40%).

Molecular Analyses for DNA Barcoding and Biodiversity Measurement

Course Coordinator: *Prof. Barbara Mable (Barbara.mable@glasgow.ac.uk)*

Course Aims: To provide practical training in and the theoretical basis for basic molecular techniques used for identification and characterisation of biodiversity. Hands-on training will be integrated with the theoretical underpinning of the manipulation and analysis of DNA sequence and microsatellite genotype data, as applied to problems in the assessment of biodiversity. This will include approaches to DNA barcoding for identification and population genetics analyses of population structure and genetic history. The goal will be for students to learn these analyses at a level sufficient to perform independent analysis of their own data. The course will also highlight recent advances in sequencing technology and approaches to genotyping, along with the new challenges that this will bring for analytical approaches.

Intended Learning Outcomes

By the end of this course students will demonstrate competence, be able to critically discuss the underpinning theoretical background, and provide an evidence-based justification to choose the most appropriate methods to apply to particular research questions related to:

- Basic molecular techniques, from sample collection through DNA extraction, PCR and visualisation
- Basic manipulation of sequence and genotyping data using appropriate specialised software and interpretion of the patterns
- Use of specialised computer programmes for analyzing biodiversity

In addition, students will be able to critically discuss in depth with respect to literature:

- The history of development of molecular techniques used in biodiversity research and the future changes that will come with continuing advances in sequencing and genotyping technology
- The scope and limitations of the range of analytical methods used to assess biodiversity through identification
- The theoretical basis behind the range of analytical methods available to infer population structure and genetic history using population genetics approaches

Assessment: Practical work will be assessed on an annotated and complete lab book that describes the procedures learned, lessons on optimisation and details on computer programmes used (30%). The remaining 70% will be an independent and evidenced-based assignment (3000-5000 words) that will require integration of the knowledge and skills learned across the range of method and theories, including sample collection, molecular methods, analytical approaches and interpretation of results in the context of the primary literature.

Multi-species Models

Course Coordinator: *Prof. Dan Haydon (Daniel.haydon@glasgow.ac.uk)*

Course Aims: This course will introduce students to the theory and practice of formulating multi-species population models. It will aim to introduce students to the different ways these models can be formulated in theory, and implemented in practice (this will be undertaken in the R programming environment). Students will be asked to review a range of previous uses of these forms of models, and be asked to develop critical views of them. Emphasis will be placed on identifying the key assumptions of these different models, and when different formulations are most appropriate.

Intended Learning Outcomes

By the end of this course students will be able to discuss critically with respect to the evidence base and primary literature:

- Applications, limitations and assumptions of the main areas of multi-species population models
- Features of a range of commonly used multi-species population models, and evaluate the various assumptions that each make
- Examples of when these different models have been applied to particular situations, and what different sorts of predictions such models are most appropriate for
- Current issues and controversies in this area of multi-species ecological modelling

In addition, they will be able to:

- Implement a range of different multi-species models in R, and be able to conduct comprehensive numerical analysis of these models.
- Estimate critical parameters contained within these different formulations, and determine how the stability of these models depends on their formulation and parameterization.

Assessment: Students will write a reflective portfolio in the form of a logbook, reflecting participation and competencies learned during practical laboratories (50%). The remaining 50% will be a take home problem-based assignment that will require integration of the knowledge and skills learned in this module, as well as short answer critical discussion of the key concepts.

Phyloinformatics

Course Coordinator: Prof. Rod Page (rod.page@glasgow.ac.uk)

Course Aims: To provide evidence-based advanced practical training in using web services to aggregate and visualise biodiversity data, using an interactive and open-access based approach.

Intended Learning Outcomes
By the end of this course students will be able to:

- demonstrate advanced competence in querying biodiversity databases and be able to critically discuss with respect to the primary literature their most appropriate uses
- critically discuss with respect to the literature the strengths and limitations of existing biodiversity databases
- Consider a biological question related to phyloinformatics and take an evidence-based approach to determine which current databases and services are relevant to answering that question

Assessment: Students will write a reflective portfolio in the form of a logbook, reflecting participation in tutorials and laboratories (20%). Students will be assessed on an independent and evidence-based assignment (3000-5000 words) where they will critically apply the techniques learnt to a specific problem (80%).

Single-species Models

Course Coordinator: Dr. Jan Lindström (jan.lindstrom@glasgow.ac.uk)

Course Aims: This course will introduce students to the theory and practice of single-species population models. It will aim to introduce students to the different ways these models can be formulated in theory, and implemented in practice (this will be undertaken in the R programming environment). Students will be asked to review a range of previous uses of these forms of models, and be asked to develop critical views of them. Emphasis will be placed on identifying the key assumptions of these different models, and when different formulations are most appropriate.

Intended Learning Outcomes
By the end of this course students will be able to critically discuss with reference to the evidence base and primary literature:

- The applications, limitations and assumptions of the range of currently used single-species population models
- The key features of a range of commonly used single-species population models, and evaluate the various assumptions that each make
- Examples of when these different models have been applied to particular situations, and what different sorts of predictions such models are most appropriate for current issues and controversies in this area of ecological modelling

In addition, they will be able to:

- Implement a range of different single-species models in R, and be able to conduct comprehensive numerical analysis of these models
- Estimate critical parameters contained within these different formulations, and critically evaluate the sensitivity of model outputs to these parameters

Assessment: Students will write a reflective portfolio in the form of a logbook, reflecting participation and competencies learned in laboratories (50%). The remaining 50% will be a take home problem-based assignment that will require integration of the knowledge and skills learned in this module, as well as short answer critical discussion of the key concepts.

Spatial and Network Processes in Ecology & Epidemiology

Course Coordinator: Prof. Rowland Kao (Rowland.kao@glasgow.ac.uk)

Course Aims: The aim of this course is to introduce students to the importance of spatial processes in ecological and epidemiological interactions. There is a substantial change in the assumptions of models that are 'well-mixed' and essentially 'non-spatial', and a spatially explicit representation – be it in continuous or discrete, point based, network-based or patch-based. The primary aim of this course is to equip students to critically appreciate, understand, describe and work with these different model formulations and their correct interpretation.

Intended Learning Outcomes
By the end of this course students will be able to critically discuss with respect to the evidence base and underlying theories:

- The difference between globally and locally driven spatial processes
- How different spatially driven contact mechanisms allow some populations to persist, and provide appropriate examples for each mechanism
- Percolation phenomena, and their relationship to the persistence of infectious pathogens
- How different spatially driven contact mechanisms can be used to control pathogens and promote conservation, providing appropriate examples from the primary literature

In addition, students will be able to:

- Develop simple computer models to demonstrate these phenomena

Assessment: Students will write a reflective portfolio in the form of a logbook, reflecting participation and competencies learned during practical laboratories (30%). The remaining 70% will be an independent assignment that will require integration of the knowledge and skills learned in this module (3000-5000 words).

Vertebrate Identification

Course Coordinator: Dr. Stewart White (stewart.white@glasgow.ac.uk)

Course Aims: The aim of the course is to provide students with core evidence-based training in techniques for identifying key vertebrate groups, including bird songs and mammalian scats.

Intended Learning Outcomes
By the end of this course students will be able to take an evidence-based approach to:

- Identify species from key invertebrate groups, to the lowest taxonomic level possible for that group
- Use taxonomic keys and the principles behind them so that they can understand and implement the use of novel keys for groups that have not been studied directly in this course
- Understand and calculate biodiversity based on a range of indices and choose those most relevant to the taxa under study
- Consolidate the methodologies learned, in terms of an in-class laboratory test to evaluate their ability to use keys
- Devise and deploy a digital collection (i.e. photographs and/or bird songs) for which complete species descriptions are generated, such as would be found in a monograph describing a new species

Assessment: Students will prepare a reflective portfolio in the form of a logbook, reflecting participation in tutorials and laboratories (20%), as well as demonstrating proficiency in identification through in-class tests (40%). Students will integrate knowledge learned in the preparation of an independent and evidence-based assignment in the form of a monograph of species description or creation of a novel key (40%).

Term 3: Research Project

Course Coordinators: Dr. Roman Biek (roman.biek@glasgow.ac.uk), Dr. Ruedi Nager (ruedi.nager@glasgow.ac.uk)

Course Aims: The aim of this course is to have students undertake a quantitatively oriented independent research project, in which they will use the knowledge gained in the taught course components to design a feasible experiment, write a proposal, and implement, analyse and write up a discrete project.

Intended Learning Outcomes

*By the end of this course students will be able to i*ntegrate knowledge learned across the taught components of the course to:

- Identify a research problem and an appropriate species in which it can be studied
- Design an experiment that is feasible in the timeframe of the third term
- Write a proposal that outlines the motivation for the study, a clear statement of the objectives to be addressed, the basic methods to be used and the expected outcomes and significance
- Undertake a quantitatively oriented independent research project based on this proposal
- Write a 10,000 word report of the study formatted for an identified scientific journal (eg Ecological Monographs).

Assessment: Students will be required to write a comprehensive report, based on independent research that is analysed using the most appropriate quantitative methods learned during the first two terms of their programme, and written up to a high standard of English, in the style of a research paper appropriate for publication, including a critical analysis of the background literature and how their results fit into the context of the broader body of literature (up to 10,000 words; 50% of the mark). Students will be required to submit a research proposal (1000 words) before starting on their projects (25%) and will be given a mark for performance and diligence during the experimental and analytical parts of the project (25%). Details of the requirements and format of the project write-ups will be provided separately for the AWSEL and QMBCE programmes.

Overall Aims of MSc/PgDip offered through IBAHCM

Specific aims of programme

- To present an in-depth and up-to-date programme that gives insight into the principles of biodiversity, conservation and animal welfare at a level appropriate for a professional scientist
- To develop the student's competence in study design, data analysis, scientific writing and communication skills in a quantitative and scientific context appropriate to enable independent research and publication quality outputs, as well as communicating to a broader range of audiences (e.g. for public outreach)
- To train the student in a range of specialised skills, techniques, practices and analyses required for state-of-the-art research in the fields of biodiversity, conservation and animal welfare
- To train students to deal with complex ethical and professional issues and make informed judgements based on exploring the most recent research, as described in the primary literature
- To enable students to develop a critical understanding of a range of specialised theories, principles and concepts integral to developing a career in biodiversity, conservation and animal welfare related fields
- To allow students the opportunity to demonstrate originality or creativity in the application of knowledge, understanding and/or practices, including critical analysis of the latest scientific literature
- To provide the opportunity to study in-depth a choice of current issues in biodiversity, conservation and animal welfare through a research project that involves setting their own results in the wider context through critical evaluation of the evidence base in that field, assimilation and synthesis of information relevant to their specific study, with reference to the latest literature and identification of the strengths and weaknesses in their own approach and results
- To encourage students to work effectively and independently, to develop a professional attitude to what they do and to take full responsibility for their own learning

Intended Learning Outcomes

The programme provides opportunities for students to develop and to demonstrate a high level of knowledge and critical understanding, proficiency with specialised skill sets, critical thought and integration of knowledge across courses, independent research abilities and other attributes in the following areas:

***Knowledge and Understanding**:*

By the end of this programme students will be able to:

- Critically discuss with reference to the primary literature, the fundamental theories, principles, and best practice in quantitative skills in ecology, in measurements and analysis of biodiversity, or in welfare research and ethics and its contribution to legislative change, as appropriate to the chosen specialisation
- Discuss in-depth relevant key techniques, and critically evaluate choice of methods appropriate to a given problem, set in the context of up to date primary literature in the relevant field
- Assimilate and synthesise appropriate information in the context of their specific study in order to critically discuss current problems in their chosen specialisation and apply advanced and evidence-based principles to the debate of currently topical issues
- Critically apply evidence-based knowledge and synthetic understanding of the appropriate scientific topic and practical techniques in biodiversity, conservation and animal welfare to critically reflect on and solve analytical, design or theoretical problems in their field of research
- Critically evaluate the national and international role of biodiversity, conservation and animal welfare and the impact of these fields in a global context with reference to the evidence base to a depth that would enable involvement in public debates

Skills and Other Attributes:

By the end of this programme students will be able to:

Subject-specific/practical skills

- Use a range of advanced and specialised skills, involving a wide range of software to support and enhance research problems in the chosen area and specify new software of refinements/improvements to existing software to increase effectiveness
- Competently design an experimental study, analyse data, write up experimental methods, results and conclusions, and critically discuss, with reference to results in the context of the most relevant and up to date research in the field
- Make a critical analysis, solve problems and draw valid conclusions from the results of experimental investigations, based on consolidation and understanding of the underlying methodologies and theories
- Acquire key practical skills in contemporary methods and techniques in their particular field of research and apply these skills to independent research problems
- Access, evaluate and discuss the most relevant and important literature in their field of choice, including a critical evaluation of the material and discussing potential future research possibilities
- Develop specific objectives to be addressed in an independent research project in the form of a research plan prepared according to the requirements for a research council grant, update it and adjust a work programme in order to efficiently conduct a research project to a realistic time schedule, including deciding on realistic experimental design and evaluation of specific hypotheses to be tested, and effective management of a research budget
- Undertake a supervised research project and effectively and concisely communicate the results to a standard appropriate for publication in a journal article

Intellectual skills

- Critically discuss the underlying principles and assumptions in the chosen subject, apply these principles to identify, conceptualise and define abstract or practical problems and issues
- Apply rigour in scientific reasoning that would enable development of original and creative responses to problems and issues
- Discuss critically the significance and importance of the topics, methods and techniques and understand the interplay of relationships with other concepts in the range of courses taken
- Discuss critically with respect to the primary literature the value of interdisciplinary approaches to scientific learning

Transferable/key skills

- Carry out an appropriate search of the scientific literature including comprehensive assessment of the relevant body of literature and choosing the most relevant and appropriate papers for the specific subject under exploration
- Communicate clearly and concisely complex material both orally and written in a scientific standard that would allow presentation in a journal or at an international conference
- Exercise substantial autonomy and initiative in designing, implementing, analysing and presenting a self-directed research project
- Apply logical analysis to novel problem solving using a wide range of methods and theories
- Discuss the issues, opportunities and limitations of research projects, reflect on their own research outputs as well as those encountered in the primary literature
- Demonstrate numeracy and literacy in written reports, project work and examinations by combining a wide range of methodologies and computer programmes
- Demonstrate personal organisational skills in their approach to effective learning and time management
- Work effectively as part of a team as well as independently and take on leadership roles in group projects

Learning and Teaching Approaches

- Lectures to introduce the theoretical background to the particular subject area and to provide guidance on completing the practical components
- Hands-on practicals providing skills in computer, field and/or wet laboratory based approaches
- The ratio of lectures to practicals will vary by individual course, with some being primarily skills and thus laboratory and field based and some being more conceptually and thus lecture based
- Students will be expected to embark on independent learning to enable them to understand the broader context of the subject areas in which they are gaining practical training
- The focus will be on research-lead teaching that is learner centred and research-problem based
- Some courses will include small group learning opportunities such as seminars, discussion groups and debates

Practical information

Useful Contacts
Course Coordinator (QMBCE): Dr. Roman Biek (roman.biek@glasgow.ac.uk) GK Rm 401
Course Coordinator (AWSEL): Dr. Ruedi Nager Ruedi.nager@glasgow.ac.uk GK Rm 425
Institute Administrator: Eileen McGee Eileen.mcgee@glasgow.ac.uk GK Rm 203
Institute Senior Secretary: Lorna Kennedy lorna.kennedy@glasgow.ac.uk GK Rm 205A
Graduate Secretary: Florence McGarrity Florence.mcgarrity@glasgow.ac.uk GK Rm 205B
Graduate Student Reps: Hannah Trewby h.trewby.1@research.gla.ac.uk and Kirstyn Bunker k.bunker.1@research.gla.ac.uk
Graduate Student Coordinator: Dr. David Bailey david.bailey@glasgow.ac.uk GK Rm 403
Institute Director: Prof. Dan Haydon Daniel.haydon@glasgow.ac.uk GK Rm 314
Animal & Plant Sciences Cluster Coordinator: Prof. Barbara Mable, Barbara.mable@glasgow.ac.uk GK Rm 404

On-line resources: We will circulate information electronically as much as possible. Early in semester 1, you will receive information on use of the University Virtual Learning Environment, MOODLE2. Staff will post information on MOODLE2 on a regular basis, including course materials. We would also encourage you to interact with one another using chat groups available through MOODLE2, facebook, or other on-line social networking options (e.g. sharing files through GOOGLE documents, Mendeley or Dropbox).

Equipment: For all courses a laptop computer will be required. You may be able to borrow one for classes, but you are strongly advised to purchase your own laptop. The University IT services web page (http://www.gla.ac.uk/services/it/) has links to suppliers.

Seminars and Discussion Groups: There are weekly seminars on Friday afternoons at 4 pm in which PhD students and postdocs present informal half-hour talks (there are two talks each week). There is also an Institute Seminar series on Wednesdays at 1 pm. You are encouraged to attend these to find out what type of research is going on in the department. There are also various discussion groups on particular research themes that will be running, as well as a postgraduate journal club that we'll keep you informed about. Part of your portfolio for the key research skills module will be to keep a logbook of discussion groups and seminars attended that includes a critical analysis of the papers discussed or presentations provided. The institute also has a podcast ("Naturally Speaking") that highlights particular research areas or topics related to "surviving" in an academic environment (http://naturallyspeakingpodcast.wordpress.com/). The Institute has a calendar of events.

Social Events: An important part of postgraduate programmes is socialisation with other students, postdocs and staff members. There is a social room on the ground floor of the Graham Kerr Building where people can go for coffee in the mornings (most people go between 10:30 and 11:30) and those who bring their lunch can eat together (most people go between 12:30 and 1:30 pm). There are a number of cafeterias on campus and a lot of restaurants close to the University if you prefer to buy your lunch. Some people also have a tea break in the afternoon (usually between 3 and 4 pm).

On Fridays, there is a tradition of going to pubs after the seminars. A facebook site (https://www.facebook.com/groups/217683908272058/) has been set up to make it easier for people to find out where everyone will be going. On Wednesday evenings sometimes the seminar speakers will stay and students are welcome and encouraged to meet them under a relaxed setting by going to a pub and/or restaurant.

Schedules: Although the class schedules will be output from MyCampus, there might be slight scheduling changes throughout the term so you should use the schedules that will be kept updated on the MOODLE websites. There is also a Google calendar that has been set up with all of the classes for both MSc programmes listed. You can subscribe using the following link: Calendar ID: d9qaa0vvgg3tguisaujplc3b98@group.calendar.google.com

Feedback Sessions: Feedback sessions will be arranged with the course coordinators at least once per term where you will be able to discuss any issues arising in an informal setting. We welcome your input, particularly as this is a new course that can develop in various ways. You also should feel free to contact us with problems or suggestions outside of these times and to communicate with one another. There will also be feedback surveys on MOODLE to fill out; we use this information to continue to improve the course so please be honest about the parts of the course you particularly like, as well as those that you think could be improved. We will ask for a graduate student rep to represent the Master's students; they can also be contacted about any issues arising.

Library: Group Study Rooms: If you want to get together to work through problem sets or writing assignments together, there are a number of group study rooms in the main Library that can be booked. Advance booking isn't necessary, but is advisable as rooms are busy and groups with bookings take priority. In addition to the rooms, groups can also meet at the tables and booths, in the Social Learning Space and Cafe on level 3, for group work and discussion.

- Room 4A on Level 4 for up to 6 people
- Room 4B on Level 4 for up to 10 people
- Room 4C on Level 4 for up to 10 people
- Room 4D on Level 4 for up to 8 people
- Room 4E on Level 4 for up to 8 people
- Room 6A on Level 6 for up to 8 people
- Room 8A on Level 8 for up to 6 people
- Room 9A on Level 9 for up to 6 people

The rooms have electricity points, are wireless enabled and have whiteboards. Rooms 4A, 4B, 4C, 4E, 6A, 8A and 9A are furnished with tables and chairs, and room 4D is furnished with soft tub chairs, each with a small writing tablet attached.
Bookings: Rooms can be booked up to two weeks in advance by visiting the Welcome Desk on Level 2. Please have your student card handy as you will need this to make the booking. You will be given a receipt with details of your booking date and time, and room number. Hold on to this as it is your proof of booking, if the room is already occupied when you turn up. A booking period can last from 1 to 3 hours with a maximum of 3 hours per day per group.

Facilities: The course will be run mostly in the Graham Kerr Building (GK) but will also make use of some other University of Glasgow facilities. There is a computer cluster just off of the Museum in the GK and it will be possible to use the GK Library when it is not booked for classes. Some classes will take place at the Garscube campus in Anniesland, which is where the veterinary school and centre for virology research are located. Bus route 59/118 (First in Glasgow) goes from Great Western Road (stops opposite the Botanic Gardens) to the Switchback road, which is the side of the estate where the vet school is located. There are also buses along Maryhill road that go to the other side of the Garscube estate, where the sports complex is located. It takes about 45-60 minutes to walk to Garscube from the main Gilmorehill campus. Taxis cost about £7. A shuttle bus service is currently under development. There is also a nice cycle route along the river Kelvin and the canal:
http://www.cycle-route.com/routes/Glasgow_Centre_to_Clydebank_Loop-Cycle-Route-1623.html.

Other Facilities

- The Scottish Centre for Ecology and the Natural Environment (SCENE) is the foremost field station in Scotland for teaching, training and research in ecology and environmental sciences
- The University Marine Biological Station, Millport; The National Facility for Marine Biology Fieldwork Teaching. An institute of the University of London, managed in association with the University of Glasgow
- Cochno Estate - Large Animal Clinical Sciences and Public Health
- Manu Learning Centre Amazonian research station in southeaster Peru. An arrangement has been made with the local partners (Crees) to allow master's project students to base their projects there.

Appendix 1: Guidelines for MRes/MSc students regarding the use of figures from papers/other texts

Guidelines
Where possible it is usually best to generate your own original diagrams or tables, since they are more likely to show what you intend. Original diagrams or tables:

- help to develop and demonstrate your understanding and integration of material
- can be more informative than diagrams copied directly
- minimise any perception of plagiarism
- can include additional information not in the original source(s)
- often look superior to scanned diagrams or low resolution digital images
- can easily be generated using drawing tools in PowerPoint, for example.

However, it can take a long time to generate complex diagrams and tables, time that may be better spent understanding the topic and conducting further research. Therefore it may be appropriate to use an existing diagram or table that you have found in a published source. This is standard practice in academic publishing, wherein textbooks, book chapters and papers often include reproductions of figures originated by others, permission having been obtained from the copyright holder.

If you decide to include in your work a diagram or table from a publication:

- always make sure that the diagram or table you are using is appropriate
- use the highest possible resolution version of the diagram or table (it is now often possible to download figures from papers in PowerPoint format)
- remember you can adapt an existing figure
- draft your own legend to demonstrate understanding of the material being illustrated and include in this acknowledgement of the source, e.g.
    - Reproduced from Smith and Brown (2012). *[for a scanned or photocopied diagram]*
    - Redrawn from Smith and Brown (2012). *[when you have produced an essentially identical copy of the original]*
    - Redrawn, with modification, from Smith and Brown (2012). *[when you have made significant changes to the original, for example adding or correcting information. Significant changes should be changes which add information to a diagram.]*
    - Original diagram, compiled from information in Smith and Brown (2012) and Wilson et al. (2011). *[when you have constructed your own diagram from the available information].*

If you are in any doubt as to how to reference a particular table or figure or whether you should produce an original diagram, please refer to your Programme Director in the first instance.

College of Medical, Veterinary and Life Sciences Graduate School
15 February 2012