

School of Biological and Chemical Sciences

MSc Ecology and Evolutionary Biology Handbook



Key Features of the Programme

- Two-week tropical ecology field trip to Borneo
- Field course in Dorset (UK) learning to convert science to policy with our River Communities Group
- Individual research project supervised by internationally recognised research scientists
- Both pure and applied research skills and knowledge taught
- Guest lectures from other London science institutions such as Natural History Museum, Institute of Zoology, Royal Botanic Gardens Kew

Contents

1. Aims, Outcomes and Assessment	3
2. Programme Structure:	6
Compulsory Modules	7
Optional Modules	10
Research Project	12
3. Academic Community	14
4. Further Enquiries	16
5. Appendix: Dissertation Guide	17

1. Aims, Outcomes & Assessment

1.1. Overall Aims

Scientists with skills and knowledge to work in ecology and evolution are needed in this time of global ecological change. This programme aims to produce such scientists, who can go on to PhD research or jobs concerning the natural environment.

There will be an emphasis on learning about research through practical application, and personal experience of the research process.

The programme will enable you to:

- Develop a sound knowledge-base in the fields studied, and key transferable skills in the areas of: communication, numeracy, information technology, working with others, problem solving, time and task management
- Develop a portfolio of experimental skills and practical techniques, and thereby provide you with the confidence to tackle more extended research studies, perhaps via a PhD
- Foster an enquiring, open-minded and creative attitude, tempered with scientific discipline and social awareness, which encourages lifelong learning



1.2. Learning outcomes

This programme will teach the application of good scientific principles in the context of independent and innovative thought. You will be expected to achieve an advanced, inter-disciplinary understanding of techniques and methodologies applicable to the fields of ecology and evolutionary biology, and an appreciation of the current research issues which are driving the science forward.

In particular, you should be able to demonstrate:

- The ability to synthesise information with critical awareness in a manner that may be innovative, using existing knowledge or cutting-edge, contemporary processes from the forefront of the discipline
- A level of conceptual understanding that will allow you critically to evaluate ecological and evolutionary research, advanced scholarship and methodologies, and to argue alternative approaches
- Initiative and originality in problem solving, and be able to act autonomously in planning and implementing tasks at a professional or equivalent level
- Develop skills in evolutionary inference, bioinformatics, field-research and laboratory research

From a practical training perspective, you will:

- Acquire technical expertise, and be able to perform tasks smoothly with precision and effectiveness
- Be able to adapt skills and design or develop new skills and/or techniques, for new applications that engage with user needs

Students taking the Postgraduate Certificate will achieve a substantial subset of the above skills through completion of the four compulsory modules in Semester A, but will not complete an independent research project and thus, will not have the experience of combining all of the above to produce a thesis.



1.3. Teaching, learning and assessment strategies

The modules making up the programme will be taught in blocks of two weeks, with a subsequent weeklong study break to use for independent learning and fulfilling the requirements of continuous assessment exercises.

Most modules comprise lectures during the morning of each day and then the afternoons are dedicated to seminars, breakout discussion groups, workshops, and laboratory or computer-based practicals. Much of the theory gleaned from formal teaching during the modules in Semester A will be placed in 'real' context on the residential field course in Borneo, which will comprise site visits, as well as management and conservation presentations from practitioners and stakeholders. Practical skills will be learned from activities associated with field trips (day-long) and in more-extensive laboratory sessions, associated with the modules. This training in practical skills will build towards the completion of a substantive research project, which should coalesce from the theoretical, practical and transferable skills.

Outline of assessment for the award of MSc

Coursework (50% of final grade): Taught modules will be assessed using a variety of assessment methods (reports, essays, practicals, presentations, MCQs). Each module is weighted at 8.33% of the final assessment load.

Dissertation (50% of final grade): The examination of the research project is via a thesis (100%).

All taught modules and the dissertation must be passed at 50% for award of the MSc.



2. Programme Structure

The programme is structured to allow logical progression through the various modules.

In Semester A, you will take four two-week modules (4 x 15 credits). In Semester B students take one further two-week module (15 credits) and the field course to Borneo (15 credits). For the remainder of the programme you will be engaged in a cutting-edge research project (90 credits), a piece of independent and novel research that should draw upon many of the aspects taught and the skills experienced.

You are encouraged to use the independent study time to engage with current researchers in labs, or volunteer for fieldwork assistance, thereby exposing yourself to the day-to-day experience of the research environment. You are encouraged to attend lab meetings also and gain a full understanding of the breadth of research available before making a choice for your own specific project.



2.1 Compulsory Taught modules:

Sem A - BIO735P Ecological Theory and Applications – 15 credits

Staff: Rob Knell

In this module we look at the theory behind our understanding of ecological systems and how that theory can be applied to ecological problems in the real world. Starting with populations of a single species we will progress to understanding two-species interactions including predation, competition and parasitism and then to whole



communities of interacting organisms. We will then study how ecological theory, used in concert with population genetics and evolutionary theory, can be applied to understanding ecological issues such as the conservation of small populations, harvesting natural populations and predicting responses to environmental change.

Reading List

Begon, M., Townsend, C. and Harper, J. Ecology. 4th edition, Wiley.

Braude, S. and Low, B. An Introduction to Methods and Models in Ecology, Evolution, and Conservation Biology. Princeton University Press.

Sem A - BIO737P Ecosystems: Structure & Functioning – 15 credits

This module is shared with the MScs in Aquatic Ecology by Research.

Staff: Beth Clare, Andrew Hirst, Mark Trimmer, Pavel Kratina

While we have long appreciated the structure of ecosystems, the importance of ecosystem functioning has lagged behind somewhat. This module aims to redress the balance by exploring the use of modern tools, which allow us to thoroughly integrate measures of ecological structure and functioning. Aspects of the Metabolic Theory of



Ecology, body-size relationships, stable isotope analysis and DNA bar-coding will all be covered in relation to topics such as photosynthetic and chemosynthetic primary production; the impacts of invasive species; aquatic-terrestrial linkages and cross ecosystem boundary subsidies; biogeochemistry and nutrient dynamics; plankton dynamics and organismal physiology in a changing world.

Sem A - BIO781P Statistics & Bioinformatics – 15 credits

Staff: Rob Knell, Steve Le Comber, Yannick Wurm

This module is shared with the MScs in Bioinformatics, Ecology and Evolutionary Genomics, Aquatic Ecology by Research, Freshwater and Marine Ecology, and Plant and Fungal Taxonomy, Diversity and Conservation.

The module provides you with an essential training in experimental design, data handling and data analyses in a context appropriate for environmental and evolutionary biology. The module will establish a solid foundation from previous knowledge, and then progress to more advanced methods. The course focuses on how to select the appropriate method of analysis, how to analyse data using the statistical programming language R and how to interpret the output of that analysis. The first half of the module will deal with parametric statistics including general and generalized linear models, and the second half will move onto multivariate statistics and the basics of Bayesian analysis.

Reading List

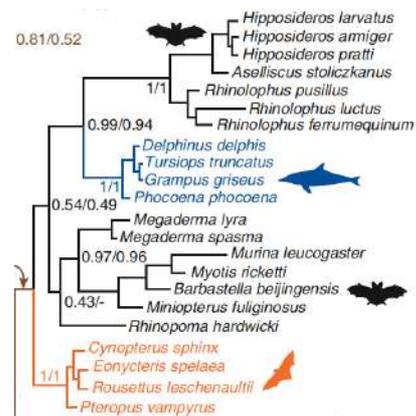
Introductory R - Rob Knell <http://www.introductoryr.co.uk>

Sem A - BIO731P Research Frontiers in Evolutionary Biology – 15 credits

Staff: Richard Buggs, Richard Nichols, Steve Rossiter, Andrew Leitch.

Guest lecturers: James Shapiro (U. Chicago), Ilia Leitch (RBG Kew), Richard Bateman (RBG Kew)

We will explore the frontiers of research in evolutionary biology. Topics covered will include: gene trees versus species trees, phylo-genomics, neutral versus selective forces, molecular convergence, the origin of angiosperms, the evolution of sociality, the significance of whole genome duplication and hybridisation. Current methods being used to tackle these areas will be taught, with an emphasis on DNA sequence analysis and bioinformatics.



Whereas undergraduate degrees commonly focus on what we know, this Master's module will shift the focus onto what we don't know. You will learn to ask relevant questions, and design approaches to seeking answers to those questions.

Reading List

Evolution - Barton et al., Cold Spring Harbor Laboratory Press, 2007

The Origins of Genome Architecture - Lynch, Sinauer, 2007

Big Questions in Ecology and Evolution - Sherratt and Wilkinson, OUP, 2009

Life Ascending: The 10 Great Inventions of Evolution - Nick Lane, Norton/Profile 2009

Sem B BIO739P Science, Policy & Management – 15 credits

Staff: Mark Trimmer, Iwan Jones & staff from the River Communities Group, plus the Environment Agency and guest lecturers from external agencies

Without knowledge, there can be no application. This module is designed to bring you ‘face to face’ with the regulators, policies and their science base, as these potential employers (e.g. CEFAS, Defra, the Environment Agency, Natural England) will give lectures on topical issues. The focus is on human impacts upon ecosystems, including pollution and habitat alteration and how these can be mitigated. National and international legislation and directives are considered (e.g. EU Water Framework Directive). Guest lecturers will also include consultants who will be able to advise on career paths.

As a detailed case study, you will visit the River Communities Group based in Dorset for one week and investigate the link between successful science and policy: for example, contemporary aspects of the EU Water Framework Directive will be considered, including underlying methodology behind bioassessment and biomonitoring (e.g. RIVPACS). This will be closely linked to how the Environment Agency are working with Defra Test Catchments (DTCs).



2.2 Optional Taught Modules

Sem B - BIO792P Ecology & Evolutionary Biology field course – 15 credits (residential field course in Borneo)

This is an optional module, the alternative being SBSM041.

This module is shared with the MSc in Freshwater and Marine Ecology

Staff: Stephen Rossiter, Rob Knell

The module will be conducted over 12 days at Danum Valley, Sabah, Malaysia. Topics will include a characterization of the food web of the humicly stained and hydrologically unstable peat swamp lake and flashy rainforest rivers, adaptations expressed by fish in such waters, impacts of catchment characteristics on the ecology of aquatic organisms, and potential threats to tropical forests and lakes. There will also be some riparian ecology for balance: the characteristics of tropical rainforests, adaptations in tropical plants, processes such as pollination, seed dispersal, herbivory and decomposition. Conditions can be tough in terms of humidity and temperature and so participants should be reasonably fit. Fieldwork will be conducted on foot, by kayak, and by swimming!

Due to the nature of the fieldwork on this module, it may not be suitable for students with some ongoing medical conditions. Any student with such conditions interested in this module should discuss it with the SBCS Student Support Officer. In the event that it is not possible to make suitable accommodations it may be necessary to choose an alternative module.

Reading List

Corlett R (2009) *The Ecology of Tropical East Asia*, Oxford University Press, Oxford

Dudgeon D (Ed.) (2008) *Tropical Stream Ecology*, Academic Press, London

Kricher JC (2011) *Tropical Ecology*, Princeton University Press

Osborne PL (2012) *Tropical Ecosystems and Ecological Concepts*, Cambridge UP

Primack RB & Corlett R (2005) *Tropical Rain Forests: An Ecological and Biogeographical Comparison*, Blackwell, Malden, MA

Sodhi NS, Brook BW & Bradshaw CJA (2007) *Tropical Conservation Biology*, Blackwell, Malden, MA

Whitmore TC (1998) *An Introduction to Tropical Rain Forests*, Oxford UP



BIO793P Population Biology field course – 15 credits (residential course in Crete)

This is an optional module, the alternative being SBSM030.

This module is shared with the MSc in Ecology and Evolutionary Biology

Staff: Aris Moustakas

On this field course we will explore the use of statistical methodology in designing, collecting, analyzing, interpreting, and presenting population dynamics experiments and observations.

We will cover elements of experimental design, hypothesis testing and statistical inference, analysis of variance, correlation, and up-to-date regression techniques. Throughout the course the application of statistical techniques within a biological context will be emphasized using data that will be collected in the field merged together with larger datasets available from the Natural History Museum, Crete. Further on site visits to rare species and rare habitats will be made, linking population dynamics problems with practical issues in conservation biology.

Reading List

Blondel, et al. The Mediterranean Region: Biological Diversity in Space and Time, Oxford Biology, 2010

Matloff. The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, 2011

Quinn and Keough. Experimental Design and Data Analysis for Biologists, Cambridge University Press, 2002



2.3 Individual Research Project (Dissertation)

Sem B & Sem C - BIO703P Ecology & Evolutionary Biology Research Project

Staff: Projects offered by different staff according to student research interests and expertise.

This module involves a novel piece of research, typically combining field sampling, experimentation, laboratory work, and data analysis. Most projects are offered to students so that they can benefit from close alignment with current PhD or Post Doctoral research within specific research groups, at QMUL or in partner institutions within London. The diversity of expertise of lecturers involved with the programme means that good supervision can be found for a broad range of studies in ecology and evolutionary biology. Dissertations may be undertaken with the assistance and guidance of relevant external organisations with the provision that a suitable SBCS supervisor is also identified.

The dissertation aims to make a novel contribution to scientific knowledge. It should demonstrate familiarity with the relevant literature and current scientific / environmental management debates to which the research contributes. In undertaking such an extensive project, you are expected to demonstrate a sound understanding of project design, sample collection, data analysis, and the ability to produce a coherent and well-structured piece of written reporting.

During Semester A, you will be encouraged to talk with potential supervisors and 'shadow' our current PhD students. From February through to the end of July, you should be undertaking lab or fieldwork, and then writing up in August for an early September submission. At the beginning of August, each student will prepare and give a research seminar based upon their work to an audience.



Examples of projects:

- Flow cytometry to measure rates of hybridisation in *Tragopogon* populations in London
- The study of sensory genes in echolocating bats and whales
- Using PCR molecular markers to understand origins of box (*Buxus sempervirens*) trees in the UK
- Ecosystem engineering by the invasive red swamp crayfish
- Identifying the genes and evolutionary mechanisms involved in the evolution of social behaviour
- Bioinformatic analyses of tree genomes
- Macronutrient cycling in aquatic ecosystems
- Trophic interactions between sympatric amphipod invaders in the R Thames
- The evolution of mating systems and especially of sexual ornamentation
- The systematics, phylogeny and phylogeography of neotropical bats and uses molecular methods for dietary analysis
- Effects of nitrogen & phosphorus on genome evolution in angiosperms
- The evolution of giant genomes

For further details of the research interests of the potential supervisors above, please visit the Academic Staff web page links from the SBCS Organismal Division homepages: <http://www.sbc.s.qmul.ac.uk/about-us/researchdivisions/index.html>

Or follow our exploits via Twitter: [@QM_EcoEvo](https://twitter.com/QM_EcoEvo)



3. Wider Participation in the Academic Community

3.1. Links with other QMUL MSc courses:

This MSc programme has one or more shared modules with the following MSc programmes taught by the School of Biological and Chemical Sciences at QMUL:

- Aquatic Ecology by Research
- Freshwater and Marine Ecology
- Evolutionary and Ecological Genomics
- Bioinformatics
- Plant and Fungal Taxonomy, Diversity and Conservation

3.2. Science lectures in London:

Students will also be able to attend other relevant lectures in London as part of several different seminar programmes including those of the:

- QMUL SBCS Organismal Biology seminar series
- QMUL Geography seminar series
- London Centre for Ecology and Evolution <http://www.ceevol.co.uk>
- London Evolutionary Research Network <http://londonevolution.net>
- London Freshwater Group <http://www.londonfreshwatergroup.co.uk>
- Institute of Fisheries Management

A programme of relevant lectures is communicated by e-mail with regular updates.

News & views are also expressed via Twitter: follow us on [@QM_EcoEvo](https://twitter.com/QM_EcoEvo)

3.3. Facilities:

Centre for the Aquatic and Terrestrial Environment (CATE)

Recent investment of over £1.8 million in analytical equipment and specialist laboratory facilities has established 'The Centre for the Aquatic and Terrestrial Environment' at Queen Mary, University of London. This is an exciting interdisciplinary collaboration between the Department of Geography and the School of Biological and Chemical Sciences. CATE builds on existing research strengths in areas of environmental research such as hydrology, hydrochemistry, environmental geochemistry, freshwater and marine ecology, terrestrial ecology and conservation.

The first and second rounds of the Science Research Infrastructure Fund have allowed us to invest in state-of-the-art analytical instrumentation capable of analysis of sediments, soils and water samples for a wide range of organic and inorganic species. Examples of recent research that has benefited from the new facilities includes analysis of organic and trace metal contaminants in fluvial and estuarine sediments, and quantifying the origin and composition of bed and suspended

sediments in lowland rivers.

Investment from the second round of SRIF has refurbished a suite of specialist research facilities comprising dedicated rooms for solid and aqueous phase sample preparation, and organic and inorganic trace analysis.

All these facilities are used either in the formal teaching of MSc Ecology and Evolutionary

Biology modules or available for individual research projects.

High performance computer facility

Queen Mary, University of London hosts a supercomputing facility consisting of 108 nodes with a total of over a terabyte of RAM. This capacity will be doubled in 2013. This facility is part of a £3.5 million supercomputing hub built in 2012, shared with University of Warwick, University of Birmingham and University of Nottingham. This facility is used by SBCS for analysis of genomic DNA data, and students doing projects needing intensive computation will have access to this facility.

River Communities Group in Dorset

The Group has a renowned history of research into human impacts on freshwater ecosystems, formerly as part of the Centre for Ecology and Hydrology and forebears, and more recently as part of Queen Mary, University of London. The Group developed the River Invertebrate Prediction and Classification (RIVPACS) method for biomonitoring of rivers using macroinvertebrates, in its latest form (River Invertebrate Classification Tool) the standard Water Framework Directive compliant tool used by governmental monitoring agencies throughout the UK (EA, SEPA, NIEA). While the Group is still very active in this exciting and rapidly-developing area of research, over the past decade it has broadened its range of research areas. Our current portfolio of research interests can be divided into three main areas, as well as an overarching fundamental concern regarding the impact of future climate change on freshwater ecosystems.

4. For more information on aspects of the Ecology and Evolutionary Biology MSc Programme

An application pack and further information on fees, financial support and studying at QMUL can be obtained from the address below:

Postgraduate Admissions
School of Biological and Chemical Sciences
Queen Mary, University of London
Mile End, London E1 4NS

Tel: 0207 882 3328

Fax: 0208 983 0973

e-mail: sbcs-pgadmissions@qmul.ac.uk

Or visit the [website](#)

This booklet provides information for those interested in the MSc Ecology and Evolutionary Biology. While every effort has been made to ensure that the information in this handbook is correct at the time of going to press, the School cannot be responsible for any errors it contains. The School reserves the right to cancel or make adjustments to the specifications of particular modules if necessary.

5. Appendix

Queen Mary, University of London

MSc Guidelines for the Preparation and Submission of a Dissertation

A dissertation forms an integral, assessed component of the MSc. It should report the results of an original piece of research, which includes fieldwork and/or laboratory analyses on a topic relevant to the MSc course syllabus.

Dissertations should include:

- (i) a clear statement and explanation of the problem being examined
- (ii) relevant background information, including a concise literature review and evaluation of proposed methodology
- (iii) details of the data collected and the various analyses carried out
- (iv) interpretation of results
- (v) discussion of the wider context and relevance of the results
- (vi) conclusion(s).

The written text should be supplemented by appropriate tables, maps, diagrams, photographs and other illustrative material.

Preparation of the Dissertation

Dissertations must conform to the following layout.

Format

Dissertations should not be more than 10000 words in length, exclusive of References and Appendices. You are advised that conciseness is a desirable quality in producing a scientific report and that your ability to write concisely will be assessed carefully. A report in excess of 10000 words may lead to loss of marks. Check a few papers in a recent issue of a respected journal (e.g. Freshwater Biology) for further guidance.

Page sizes for the dissertation are to be A4. Dissertations must be typed, using font size 12, preferably in Times New Roman, and text is usually neater when 1.5 or even double spaced. Note that only one side of a sheet should be used for text or illustrative material. To allow for binding, the left margin should be 3.5 cm and a 2.5 cm right margin is recommended. All pages must be numbered. Preliminary pages (Title through to Lists of figures etc., see below) should be separately numbered using Roman numerals.

Number of copies

TWO copies are required, both of which should be bound using comb binders and have a front cover as on page 10; a declaration form (similar to page 11) should also be completed and submitted with your thesis (a word version will be mailed to you nearer the time). Own copies will be additional to the two submitted.

Elements to be included (logically in this order)

TITLE PAGE - stating the following:

- (i) The title of the dissertation
- (ii) Your name
- (ii) The year of submission
- (iii) The following statement:

‘This research dissertation is submitted for the MSc in Ecology and Evolutionary Biology at Queen Mary, University of London’

DECLARATION – that the dissertation is your original work, specifically prepared for the final examination (form at the end of this document)

ABSTRACT of no more than 400 words, plus a statement of the NUMBER OF WORDS in the text

ACKNOWLEDGEMENTS

LIST OF CONTENTS – giving page numbers for sections

LIST OF FIGURES – giving page numbers (this includes maps)

LIST OF TABLES – giving page numbers

LIST OF PLATES – giving page numbers

MAIN TEXT – consisting of Introduction, Aims, Study sites, Materials and Methods, Results, Discussion and Conclusions (order can be moved around as appropriate)

The Introduction usually outlines the scientific problem and approach, and should include a concise literature review logically leading into and framing the study – try and identify the research gaps that you are intending to fill. Aims should be concise. Results should be concise, descriptive and should not entail detailed discussion of what they may mean. Discussion should interpret the results in relation to the initial study aims and should set them in the wider context. This section should also include some critical comparison. Conclusions should be a concise summation of the approach undertaken and main findings of the study. In this section it may also be appropriate to provide an autocritique detailing perceptions of the strengths and weaknesses of the study.

LIST OF REFERENCES – should conform to the system adopted in the journal *Freshwater Biology* i.e. the Harvard system

APPENDIX/APPENDICES – if necessary

Dissertations: What do you want to achieve?

Many students initially view the successful production of their dissertation as nothing more than an essential part of the process to obtain an MSc. However, your dissertation can be the key to much more than this. In addition to your MSc degree, it can provide beneficial opportunities. It is important that you consider these potential benefits carefully during the planning of your project.

Your project and the resulting dissertation can provide the following opportunities:

1) Chance to acquire new skills and broaden your horizons. Your MSc is a multi-disciplinary subject and you are likely to obtain greater intellectual satisfaction and improve your employment potential if you use your project as an opportunity to acquire new expertise. Consider a topic that requires you to use new skills, rather than one that merely uses the skills developed when you were an undergraduate. Choose a subject that is relatively new to you and which will extend your knowledge into a new area of expertise. You have a unique opportunity to obtain assistance from supervisors with expertise in several disciplines.

2) Aim to get your dissertation published in a scientific journal. Most MSc dissertations are substantial pieces of work and many are potentially suitable for publication. Just a little extra thought during the preparation of your project and some additional care in writing-up can make your dissertation publishable. Your supervisor may be able to offer considerable help in this. If they make a significant contribution to the development of your project, methods of data collection and analysis, or editing, it is reasonable to consider joint publication (you would normally expect to be first author). The following example publications have arisen from FACS & AER MSc projects (student; supervisor):

Kibriya & Jones 2007 Nutrient availability and the carnivorous habit in *Utricularia vulgaris*. *Freshwater Biology* 53: 500–509

Woodward & Layer 2007 Pattern and process in the Lochnagar food web. *Developments in Paleoenvironmental Research* 231-252

Rawcliffe, Sayer, Woodward, Grey, Davidson & Jones 2010 Back to the future: using palaeolimnology to infer long-term temporal changes in shallow lake food webs. *Freshwat Biol* 55: 600-613.

Ravinet, Syvaranta, Jones & Grey 2010 Fish exploitation of methane-derived carbon in a temperate lake system. *Oikos* 119: 409-416.

Dossena, Yvon Durocher, Grey, Montoya, Perkins, Trimmer & Woodward 2012 Warming alters community size structure and ecosystem functioning. *Proc Roy Soc B*

3) Establish key contacts, perhaps with potential employers. If you undertake a project in conjunction with a specific external agency, use the opportunity to develop useful contacts. By delivering a competent and professional report in the form of your dissertation, you may impress the agency that you worked with to the

extent that they may be able to consider you as a future employee. Your university supervisors are also likely to use your project work as a guide to writing a good reference on your behalf.

4) Experience novel situations. Providing you have the confidence and skills to deliver a competent piece of work in a novel situation, you can consider a project that will require you to work in an ecosystem, context or country that is new to you. There are certain risks involved in working remote from London, but the rewards from the successful completion of a dissertation in a new and/or difficult environment can be considerable. Close liaison with a potential supervisor is essential if you are considering this possibility. It is far too easy to be over-ambitious and you need to be very flexible if your initial plans prove unworkable once you arrive at your study site.

Types of MSc Project

In general, there are four types of project that you could consider for your MSc dissertation:

a) Project of your own design. We encourage students to design and initiate their own project but reserve the right to require modification of proposals that are over-ambitious or appear unworkable. A good project of this type can demonstrate that you have considerable initiative but it is important to ensure that you are still guided by your supervisor.

b) Commissioned project. There are often projects on offer that are encouraged/commissioned by external agencies or relevant NGOs. These have the advantage of giving you experience of a real-world situation and the satisfaction of knowing that a good report will be put to use by the commissioning agency. Your work will be likely to provide a sound guide to a future employer. There may also be some financial support for such projects.

c) Project aligned to staff research. Staff teaching the MScs have their own research programmes and most will be able to identify work that can potentially be undertaken as a dissertation. This type of project may well lead to a published paper and the work will be clearly manageable as an individual project. By undertaking work that is part of a larger overall effort you are likely to acquire new skills and be able to go into considerable depth in your study.

d) Project that includes an element of adventure. If you choose to work at a remote or difficult site (e.g. outside Europe) you may make your project adventurous but there are risks attached. Projects in remote locations have often produced rather poor dissertations because of unanticipated difficulties. However, when the student undertaking a remote project has shown considerable skill in dealing with a problematical situation, the marks awarded have sometimes been excellent.

Whatever type of project you decide upon, try to maintain good contact with your supervisor whenever possible. Also remember that all staff associated with the MSc Freshwater and Coastal Sciences course may be willing to provide advice at any stage during your project, particularly when you are planning where you will work and what you will do.

Dissertations: Supervision by persons who are not members of QMUL staff

1. The appointment as supervisors of dissertations for Master's programmes of persons who are not members of the staff of QMUL and may be based overseas is subject to a number of terms and conditions which are set out below.
2. Where a Master's student's supervisor is not a member of QMUL staff, the following requirements must be met:

- Departments are responsible for maintaining adequate and appropriate project supervision and for monitoring that supervision, especially where a student is spending part or most of the time spent on the project outside QMUL.
- The *curriculum vitae* of any supervisor proposed and his/her suitability as a supervisor must be considered by the relevant Board of Examiners before he/she is formally appointed.
- A second supervisor who is a member of staff of QMUL must be appointed with responsibility for monitoring the student's progress and the level of input/direction the student is receiving from the non-QMUL supervisor.
- The second supervisor must maintain regular contact with the supervisor who is outside QMUL and should collaborate with him/her in the overall direction of the student's project.
- The second supervisor may be required to take on more than the normal supervision expected of a second supervisor.
- In the event of any problem with the supervision being provided by the supervisor from outside QMUL, the secondary supervisor will consult the department's Graduate Tutor on action to be taken.

Dissertations: Organising your Project

Topic

Many different topics are suitable. A glance at the titles of recent dissertations will give you an idea of the range of subjects studied. Most are site-based or problem-orientated. All should be original pieces of work and usually involve the collection of quantitative/qualitative data. Unless you are certain that you wish to pursue a particular specialisation in your future career, it is useful to take this opportunity to broaden your experience of the MSc by studying a topic that is relatively unfamiliar to you.

Working as part of a larger project

If you undertake your project work in association with an external organisation, you will sometimes be asked to do work that will contribute to a team project. This is all right, providing you work independently and any joint studies that may be included in your dissertation are clearly indicated as such. However, we do expect you to show initiative in developing your project, so it is unsuitable to do only routine studies according to a methodology that has been worked out in detail by others. If such studies form a part of your research, then we expect you to also include a substantial section in your dissertation that evolved from your own, independent ideas.

Schedule

You will normally be able to begin full time work on your project in late April, depending upon programme. However, it is never too early to begin to plan what you will study for your project. In the past, some students have developed projects from ideas and contacts made during Semester A. Most students plan their project during the spring term. If you are seeking to work with an external organisation it is a good idea to make an initial approach to them soon after Christmas. Nevertheless, some excellent projects have resulted from plans that were initiated as late as May!

Location

Fieldwork is usually undertaken in Great Britain. However, we are prepared to consider projects based in the European Union or beyond, provided adequate provision can be made for supervision. You should bear in mind that, if your supervisor is not able to visit you in the field, because your site is remote from London or very expensive to reach, you are unlikely to get QMUL guidance in the field should anything go wrong.

Safety

A full risk assessment must be carried out in keeping with the QMUL procedure in this respect, particularly focusing on aspects such as interviews, fieldwork, laboratory work, lone work, etc. This risk assessment must be undertaken in collaboration with your supervisor.

Funding

Some projects each year are part funded by external organisations that require a particular piece of work to be done. It is impossible to predict in advance how many such projects will be on offer in a particular year. The course tutor will gain a list of projects available, but you are also encouraged to contact other relevant organisations to identify other potentially funded projects.

The approach you should take

Whatever topic you choose to study, we expect you to adopt an approach similar to the following:

1) Clearly identify the aims of your studies and state them in the introduction:-

- What am I studying?
- Why am I studying this?
- How will the study be undertaken?
- To whom will the findings be useful?

State a hypothesis that you wish to test or a research question that you wish to explore.

2) Review the existing situation so as to put your aims into context.

3) Indicate the methods you intend to use.

4) Collect information and/or data according to your study plan.

5) Analyse your information and/or data and interpret its significance (using statistical techniques where appropriate).

6) Discuss your results and compare them with previous work.

7) Reach some conclusions and, if appropriate, make management recommendations based on your study.

You may also wish to include a final section in your thesis that reflects on the issues related to your project.

Dissertations: Working to a Timetable

Submission Date

Your dissertation must be submitted by 12:00 on the deadline day. Dissertations submitted after this date will not be accepted for consideration in the academic year unless accompanied by a doctor's note indicating your inability to submit on time and unless you have given advance warning of late submission, in writing to your programme director and programme administrator.

Dissertations that do not meet this deadline will not be considered by the examiners until the following academic year.

Setting yourself appropriate targets

The most effective way to ensure that you are able to submit your dissertation on time is to draw up a realistic timetable of work and to keep to this timetable.

The preparation of your dissertation will probably involve the following stages:

- Consideration of suitable topics
- Preparation of a draft proposal

- Discussion of proposal with staff
- Revision and finalising proposal
- Background reading and investigation
- Drafting of initial chapters (Aims, Methods, Literature Review)
- Fieldwork
- Analysis of data
- Preparation of outline of contents and structure
- Writing dissertation
- Submission of draft to supervisor(s)
- Response to feedback on draft
- Preparation of figures
- Final revision of text and ‘polishing’ of thesis
- Typing/photocopying
- Binding

Submission

It is impossible to specify exact target dates for completion of each of these stages that would be appropriate to every topic and each individual, though outline guidance is provided. However, you should try to set yourself realistic target dates in relation to your own assessment of how long each stage will take you to complete. It is often easiest to start from the date of submission and work backwards when setting your targets. Once they are set, stick to each target date rather than adjusting sliding target dates. In practice, there is always a temptation to spend longer on fieldwork, sometimes in the belief that your next set of data will prove to be the crucial one. A failure to begin the analysis and writing-up sufficiently early is the most common cause of late submission. Most students need to complete fieldwork by the end of July at the very latest, and preferably earlier, in order to submit on time.

Liaison with your supervisor

Do not forget that your supervisor will have many other things to do and may be away in August. Allow plenty of time for consultation and discussion and try to give your supervisor a very clear indication of the timetable you have set yourself. If possible, get on with other parts of your dissertation (e.g. figures, tables of data) whilst your supervisor is reading your draft thesis. Do not consult your supervisor about quite trivial matters or submit rough drafts of individual chapters: your supervisor can only be expected to comment on a near complete draft.

Dissertation length

Do not assume that your dissertation will be marked down for being too brief. You will not gain extra marks for being verbose or for the weight of the final document. You will be marked on the quality of your investigation and the way it is presented. A concise text that deals with all necessary issues is often a quality text. Theses must not exceed 10000 words without the clearance of your supervisor and justification for this word limit extension must be stated to your supervisor.

Dissertations: Using Statistics

Some information that you may collect cannot readily be subjected to statistical analyses and must be qualitatively analysed in as rigorous a manner as possible. However, providing that you carefully plan your experimental design and methods of data collection, statistics can often be used to support your argument. Indeed, if a critical point is being made, it is essential to back this up with appropriate statistical tests whenever possible. Many textbooks in statistics are available. The following texts are very "user friendly" and include many relevant examples:

- DYTHAM, C. 1999. Choosing and using statistics: A biologist's guide. Blackwell, Oxford. 218pp
- LEPS, J. & SMILAUER, P. 2003 Multivariate analysis of ecological data using CANOCO. Cambridge University Press, Cambridge.
- SOKAL, R.R. & ROHLF, F.J. (1995) Biometry (3rd Edition). W.H. Freeman and Co., New York
- ZAR, J. 1996. Biostatistical analysis. (3rd Edition). Prentice Hall, NJ, USA. 718pp

Many computer statistics packages are available. Of these, MINITAB and CANOCO are the most widely used. They cover almost every statistical test that you are likely to require, but remember to use the appropriate test rather than what is available on the package you are using.

If you have a particularly intractable statistical problem, you can gain advice from your supervisor or another member of staff. Most statistical difficulties are created by poor design of data collection methods. It is often disastrous to first collect your data and then ask the question "what statistical tests can I use to analyse these data?" Statistical analysis considerations are a crucial aspect of experimental design so it is critical that you seek statistical advice at an early stage in your thesis study. Whenever it is appropriate you should follow the practice of using a null hypothesis before carrying out a test.

Most statistical tests result in an estimate of the likelihood that a particular result could have arisen by chance. This probability is denoted by P . You are encouraged to quote a precise value of P (in which case the result is given as $P=0.014$, for instance). Alternatively, the normal convention of indicating the probability of the result having arisen by chance should be indicated by the use of $<$ (indicating less than) followed by the appropriate level (0.05, 0.02, 0.01, 0.001) taken from a set of statistical tables. You should conform to the accepted convention that any result with a probability greater than 0.05 should be regarded as not significant. In many statistical tests the interpretation of the statistic calculated is meaningless without the degrees of freedom. Thus the significance level of a particular value of t varies with the degrees of freedom as does the significance level of the correlation coefficient (r). Present the degrees of freedom using a post-fix to the statistical symbol, e.g. t_{24} , r_{28} , t_{28} .

You should ensure that the test you carry out is appropriate and the data are acceptable for the particular test. Do not confuse parametric and non-parametric tests. When using percentage data remember to correct it by first applying an *arcsin* transformation and you must not carry out non-parametric analyses on percentage data. When small samples are involved, ensure that the statistic is calculated correctly for small samples (this includes Yates' correction for the calculation of χ^2).

Examples of the style in which to present results are:

"...and the difference is significant ($\chi^2 = 6.9, P < 0.01$)"

"...the correlation between A and B is significant ($r_{28} = 0.79, P < 0.001$)"

"the difference between the samples is not significant ($t_{17} = 1.2, n.s.$)."

"Examination of the data using an ANOVA (analysis of variance) gives $F_{12,23} = 29.1$ ($P < 0.001$)."

Dissertations: Outline Timetable for production of Dissertation

The following schedule is for guidance only. You should make your own adjustments according to your personal estimation of how long each stage of your project will take. However, you are strongly advised to complete each stage on a date no later than that suggested in this schedule.

Year

- November to January Explore ideas for project with various staff and find a supervisor
- Late March Get dissertation proposals to your programme director
- April to late May Write initial sections, design data gathering and prepare for fieldwork/lab work
- May to late July fieldwork/lab work
- End July Complete data analyses
- Late July-mid-August Write text of dissertation and submit draft to supervisor (mid-August)
- End August Edit and work on sharpening presentation. Make three copies and bind two in correct covers
- Dissertation submission (you *can* submit earlier!)

Remember, that if deadlines start sliding backwards the latter and most important stages will end up being rushed, and this will affect the quality of the thesis: prepare a schedule and try your best to stick to it!