



## Programme syllabus

Faculty of Health and Life Sciences

Akvatisk ekologi, masterprogram, 120 högskolepoäng

Aquatic Ecology, Master Programme, 120 credits

### Level

Second Level

### Date of Ratification

Approved 2009-09-15

Revised 2017-01-25 by the Faculty Board within the Faculty of Health and Life Sciences

The programme syllabus is valid from autumn semester 2017

### Prerequisites

General entry requirements for second-cycle studies and specific entry requirements:

- 90 credits in Biology/Ecology/Microbiology including an independent project/degree project worth at least 15 credits or the equivalent.
- English B/6 or equivalent.

### Description of Programme

The Master of Science in aquatic ecology is at second-level, equivalent to 120 higher education credits. The program is designed to prepare professionals interested in the field of aquatic ecology and sustainable use of aquatic ecosystems. The program provide knowledge and skills for a career in education, research and innovation as well as entrepreneurs, decision makers and consultants within the aquatic field. The program is international, multidisciplinary and oriented towards current topics in aquatic and marine ecology, aquatic resources, coastal monitoring and environmental policies.

### Objectives

*Central degree objectives in accordance with the Higher Education Ordinance*

#### *Knowledge and understanding*

For a Degree of Master (Two Years) students must

- demonstrate knowledge and understanding in their main field of study, including both broad knowledge in the field and substantially deeper knowledge of certain parts of the field, together with deeper insight into current research and development work
- demonstrate deeper methodological knowledge in their main field of study.

#### *Skills and abilities*

For a Degree of Master (Two Years) students must

- demonstrate an ability to critically and systematically integrate knowledge and to analyse, assess and deal with complex phenomena, issues and situations, even when limited information is available
- demonstrate an ability to critically, independently and creatively identify and formulate issues and to plan and, using appropriate methods, carry out advanced tasks within specified time limits, so as to contribute to the development of knowledge and to evaluate this work
- demonstrate an ability to clearly present and discuss their conclusions and the knowledge and arguments behind them, in dialogue with different groups, orally and in writing, in national and international contexts
- demonstrate the skill required to participate in research and development work or to work independently in other advanced contexts.

#### *Judgement and approach*

For a Degree of Master (Two Years) students must

- demonstrate an ability to make assessments in their main field of study, taking into account relevant scientific, social and ethical aspects, and demonstrate an awareness of ethical aspects of research and development work
- demonstrate insight into the potential and limitations of science, its role in society and people's responsibility for how it is used
- demonstrate an ability to identify their need of further knowledge and to take responsibility for developing their knowledge.

#### *Program-specific objectives*

After successfully completing the programme for a Degree of Master the student should be able to:

- understand and apply the principles of Aquatic Ecology including the dynamic processes that affect aquatic organisms in coastal ecosystems
- demonstrate knowledge of water systems from freshwater streams to marine areas
- explain and predict ways of using analytical methods and tools to help answer scientific questions and to solve practical problems
- demonstrate skills in how to perform laboratory and field work in the Aquatic Ecology field
- use the terms and concepts of Aquatic Ecology effectively in oral and written presentations
- use the knowledge in Aquatic Ecology, integrate it with those of other disciplines, and contribute to the development of sustainable technologies.

## Content

### *Programme overview*

The programme's content and setup are designed to develop the students' knowledge of aquatic ecology at second-cycle level. For each student, an individual course of study is planned in consultation with the programme director, including mandatory and elective courses as well as project courses. In the plan, previous knowledge and experience as well as the student's aims with the programme (see above) are taken into account. The contents of the project courses are mapped out and, where appropriate, courses at other universities are planned. Before the student is registered on each project course, a detailed plan for the course's implementation and examination is prepared. The language of instruction is English but all courses can be given in Swedish if only Swedish students participate.

When it comes to elective courses, the student is guaranteed a place on a number of different courses corresponding to fulltime studies, but the student is not guaranteed a place on his or her first choice of course.

### *Programme content*

The program spans over two years, including a course in research methodology in Natural Science common to the Faculty of Health and Life Sciences at Linnaeus University. The purpose of the course is to develop the students' interdisciplinary thinking, communication and cooperation skills, expose the student to various aspects of natural sciences, as well as provide advanced knowledge of philosophy of science and ethics. During the first year, students are introduced to current research and knowledge development in aquatic ecology and will deepen their knowledge of marine microbiology, molecular ecology, aquatic and marine resources management, coastal monitoring, and biological solutions to environmental problems. The function and evolution of different aquatic systems ranging from polar to tropical and from coastal to deep ecosystems are discussed in the light of the newest molecular advances in the field. Students are also introduced to simulation modelling and ecological applications that can offer solutions to complex management problems of water resources. Relevant both for research and management, the introduction to powerful techniques for designing ecological investigations and analysing monitoring data sets enables the students to tackle environmental issues within the field.

Within the framework of the programme the students are offered a range of introductory or in-depth courses on advanced techniques (eg. statistics, bioinformatics, ecology), management issues (governance, resources management including fisheries, sustainability, business) or global change and climate related topics (ecology, toxicology and socioeconomic impact of harmful algae, spreading of pathogens, bioenergy). During the two years, students participate in a series of seminars with researcher on current topics within the field of aquatic ecology.

During the second year of the programme the student completes a degree project encompassing 30, 45 or 60 higher education credits with a suitable supervisor. The project should be conducted in a subject area related to current research conducted at the Linnaeus University Centre for Ecology and Evolution in Microbial model Systems (EEMiS). The work may also be conducted at a partner university or with a third party (e.g. Board of Fisheries, national/regional environmental planning agencies, private sector) or as a Minor Field Study. The degree project may partly be conducted in another country, as agreed between student, supervisor and examiner.

### ***Courses in the programme***

Year 1

#### **Research Methodology in the Natural Sciences (A1N) 15 higher education credits\*. *Mandatory***

The course aims to further develop and gain an understanding of the research methods that are used in the natural science research field. The course includes 6 subcourses with the following content: philosophy of science, research ethics, literature searching, quantitative research methods in the natural sciences, oral presentation skills, and laboratory safety and qualitative methods.

#### **Introduction to Research in Aquatic Ecology (A1N) 7.5 higher education credits\*. *Mandatory***

The course aims to provide an introduction to current research in the field Aquatic Ecology.

#### **Molecular Ecology (A1N) 7.5 higher education credits\*. *Mandatory***

The aim of the course is to further develop the students' competency in the area of molecular biology, with focus on genetic methods and their applications and how these can be used to answer questions in ecology, including selection, phylogenetics, population differentiation and speciation.

**Statistics for Health and Life Sciences – an Introduction , 7.5 higher education credits\*.** *Elective*

The aim of the course is to deepen the students' knowledge and application of statistical methods within the natural science research field. The course includes modules with a blend of theory and application of parametric and nonparametric statistics as well as multivariate tests used to evaluate ecological and epidemiological processes.

**Project Course in Aquatic Ecology (A1N) 7.5 higher education credits\*.**

*Elective*

The course aims to deepen and broaden knowledge of the subject aquatic ecology through a literature study of current research literature.

**Project Course in Aquatic Ecology (A1F) 15 higher education credits\*.** *Elective*

The course aims to deepen and broaden knowledge of the subject aquatic ecology through a literature study of current research literature as well as develop the skills and ability to apply this knowledge.

Year 2

**Project Course in Biology (A1F) 15 higher education credits\*.** *Elective*

The course aims to deepen and broaden knowledge of a subject field in the main field of study, biology. Will not be taken if the student writes a degree project worth 45 or 60 higher education credits.

**Project Course in Aquatic Ecology (A1F) 15 higher education credits\*.** *Elective*

The aim of the course is for the student to practice skills within experimental methodology and develop an understanding of aquatic ecology. Will not be taken if the student writes a thesis project worth 60 higher education credits.

**Degree Project in Biology (A2E) 30, 45 or 60 higher education credits\*.**

*Mandatory*

The course aims to give a deeper understanding in a subject within the main field of study, biology, as well as train the student's analytical and laboratory skills and the ability to write a scientific work. As the number of higher education credits increase the following also increase: a) the scope and depth of the questions, b) the scope and depth of the literature relevant to the subject c) the scope and depth when it comes to processing data and statistical analyses, and d) the scope and depth of the scientific synthesis that is the core of the degree project.

\*course in main field (Biology)

In order to complete year 2, the student must have completed a minimum of 60 higher education credits, of which 30 may be obtained in another field of study, in consultation with the programme coordinator.

***Relavance for society***

The Masters Program Syllabus provides experience outside academia, hence developing employability skills, and the possibility to perform degree project work in a non-academic organization.

***Internationalization***

The student has the opportunity to participate in courses at other universities in Sweden and abroad. Elective courses may be taken at other universities in consultation with the programme coordinator. The degree project can be completed at a university abroad after agreement between the student and the examiner.

### *Perspective in the programme*

The Masters in Aquatic Ecology is organized according to the principles of sustainability (integration, community involvement, gender and generation equity, ecological integrity and continual improvement). The theoretical training in the program favors ecological integrity, by protecting biological diversity and maintaining ecological processes and life support systems in aquatic environments. Practical training takes into account concrete aspects of ecological integrity (learning environment, travelling, materials, e-learning). The Masters in Aquatic Ecology also introduces the students to the concept of fairness and equal access to opportunities both in our life-time and for future generations. Equity between generations implies maintaining ecological integrity and water resources to provide for a safe quality of life, both for short and long term. The program incorporates both global and multicultural perspectives on aquatic systems and water resources, on new technology and development and on internationalization and employability.

### Quality Development

A continuous quality evaluation of the Master Programme in Disease Ecology will review how the learning environment supports the students' learning and development. Quality control work is undertaken according to the guidelines drawn up by the Faculty of Health and Life Sciences and the Department of Biology and Environmental Science. Course evaluation results are compiled in a course report and archived by the department's administration. The results of the evaluations and any changes made in the implementation of a course or its syllabus are communicated to the head of department and presented to the students the next time the course is given. Results and suggestions for improvements are discussed in a programme board (consisting of an external representative, teachers and students) and programme committee (consisting of examiners, course coordinators and programme coordinator) which provide support for the programme's development and quality assurance. The master programme is given in close cooperation with the LNU Centre of Excellence EEMiS which guarantees that teachers active in research can contribute to the quality development of the programme.

### Degree Certificate

After completing program studies, corresponding to the requirements expressed in the Higher Education Ordinance degree order as well as Linnaeus University degree order, the student may apply for a degree. Those who have completed the Study Programme Master of Science in Aquatic Ecology may obtain the following degree:

Filosofie masterexamen med inriktning mot Akvatisk Ekologi.  
Huvudområde: Biologi.

Master of Science (120 credits) with specialization in Aquatic Ecology.  
Main field of study: Biology.

The degree certificate is bilingual (Swedish/English). The Degree Certificate is accompanied by a Diploma Supplement (English).

### Other Information

After completing half of the programme the student can apply for a one year Master Degree on condition that the project course in Disease Ecology (A1F) is replaced by a degree project for a one year Master Degree in Biology, 15 higher education credits and that the general requirements for a one year Master Degree are satisfied. In that case the degree will be Master of Science in Biology with specialization in Aquatic Ecology, one year (filosofie magister i biologi, inriktning Akvatisk ekologi).