

**SOCRATES THEMATIC NETWORK
AQUACULTURE, FISHERIES AND AQUATIC RESOURCE MANAGEMENT 2008-11**

**LIFELONG LEARNING PROGRAMME
ERASMUS
Academic Network**

Report on **required new components of PhD courses**

Project Acronym: Aqua-tnet

Project title: Aquaculture, Fisheries & Aquatic Resource Management TN

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1. What do we mean by PhD courses

PhD courses as considered in this project range from a one day workshop-type event to a full semester course, which may include theory and practical work. To be included in this project courses need to be credit awarding, i.e. they need to provide opportunity for students enrolling to be assessed and demonstrate success on attendance to the course. As such the information provided includes the number of credits awarded on reaching a specified level of knowledge on the completion of the course. As a consequence of this variable approach, courses included in this database have been given a wide range of credits. In general 1 credit (ECTS) is awarded for between 25-30 hrs workload, which includes direct contact of about 10-15 hrs and 10-15 hrs of independent work. Therefore, although there is a wide range of courses included in this portal, both in terms of scope and structure, the rationale of this compilation was focused on organised and certified training that students can take while researching in the area of aquaculture (in its broadest definition).

2. The scope

a. Focus on PhD student mobility

The approach to the compilation of courses included in the PhD portal was focused on student and researchers mobility. During their research period students may require some training in certain areas which are not fully available within their home institutions. Given the breadth of the subject area of aquaculture, the provision of training in this field will not be available within one single institution, or even country, and so this website aims to facilitate information exchange in the area of course availability and provide the key portal for training for PhD students.

The objective of this WP and the work completed on gathering information on courses for PhD students in the area of aquaculture will facilitate student mobility and speed up the provision of skills in the area of aquaculture.

b. The structure of the PhD portal

The PhD portal contains two main parts. The first part provides access to a database on dedicated (so not generic) PhD courses in the Aqua-tnet domain. The second part provide access to finished PhD's and can provide information on the thesis, on the candidate and the powerpoint presentation of the defense.

3. The diversity of the courses in content and structure

PhD courses are reported with large programme-organisation variability. Some universities organize seminars on specific topics, as 2-4 hours per topic. Other universities organize courses of 1-2 ECTS including 12 hrs lectures, 12 hrs laboratory work, plus 25 hrs students' independent work. Other universities just organise the PhD classes as research activity, where students have their own research project and eventually receive specific trainings to achieve the skills needed to develop their research. Such trainings may be organized either at the same university, or to research institutes in the same countries or abroad.

Examples:

- 1) University of Insubria (Varese, Italy) organizes special workshops (6-12 hrs) on specific items that in 2010-2011 where:

- microbial biofilms and biofloc
- working groups in research
- evolution and evo-devo (evolutionary development biology)
- biodiversity (assessment, protection and exploit)
- immunity

MICROBIOLOGY
SOCIAL SCIENCES
BIOLOGY
BIOLOGY-ECOLOGY
IMMUNOLOGY

- functional genomics and proteomics in aquaculture
 - assessment and minimization of impacts of aquaculture: case studies
 - biodiversity models for the study of impacts on biodiversity
 - recirculation aquaculture and biofilter management
 - statistic in Life-Sciences
 - microscopy (optic, laser-scan and electronic) (in programme)
 - nanotechnology applications in aquaculture (in programme)
- MOLECULAR-AQUACULTURE
ENVIRONMENT
BIOLOGY
AQUACULTURE-MICROBIOL
MAT-STATISTIC
MICROSCOPY
BIOLOGY-AQUACULTURE

2) University Federico secondo, Naples, Italy, delivered:

- cryobiology of aquatic organisms
 - integrated multitrophic aquaculture
 - phytoplankton production
 - re-circulation in aquaculture systems
 - wastewater management
 - zooplankton production
- BIOLOGY
AQUACULTURE
AQUACULTURE
AQUACULTURE
ENVIRONMENT
AQUACULTURE

3) University Wageningen

- INTRODUCTION TO MATHEMATICAL MODELLING IN BIOLOGY
- ORIENTATION ON MATHEMATICAL MODELLING IN BIOLOGY
- PHD COURSE INTRODUCTION TO ELECTRON MICROSCOPY
- PRACTICAL COURSE: INTRODUCTION BIOINFORMATICS
- QUANTITATIVE GENETICS, WITH A FOCUS ON SELECTION THEORY
- STATISTICS FOR THE LIFE SCIENCES
- MATHS AND BIOINFORMC
MATHS
BIOLOGY
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BIOLOGY
MATHS

4) Norwegian Institute for Sciences and Technologies:

- ACTIVE FISHING METHODS (MR8103)
- ADVANCED AQUATIC CHEMISTRY (KJ8070)
- ADVANCED WATER AND WASTEWATER TREATMENT (VM8200)
- ADVANCED WATER CHEMISTRY (VM8203)
- AQUATIC ECOPHYSIOLOGY (ZO8024)
- BIO OPTICAL PROPERTIES & PIGMENTATION IN PLANTS (BI8060)
- BIO OPTICAL PROPERTIES AND PIGMENTATION IN PLANTS, ALGAE AND AN
- DYNAMIC ANALYSIS OF SLENDER MARINE STRUCTURES (MR8208)
- EARLY LIFE HISTORY OF FISH (AK8002)
- FISH SALTING (BT8112)
- HYDRODYNAMIC ASPECTS OF MARINE STRUCTURES 1 (MR8300)
- HYDRODYNAMIC ASPECTS OF MARINE STRUCTURES 2 (MR8306)
- HYDROLOGY, ADVANCED COURSE (VM8105)
- FISHERIES
CHEMISTRY
ENVIRONMENT
CHEMISTRY
BIOLOGY
BIOLOGY
ENGINEERING
BIOLOGY
FOOD
ENGINEERING
ENGINEERING
ENGINEERING

LABORATORY ANIMAL SCIENCE FOR RESEARCHERS (NEVR8003)	BIOLOGY
MARINE ACOUSTICS II (TT8305)	ENGINEERING
MARINE BIOCHEMISTRY (BT8114)	BIOLOGY
MARINE GEOTECHNICAL ENGINEERING (BA8301)	ENGINEERING
MARINE LIPIDS (BT8117)	BIOLOGY
MICROBIAL ECOLOGY (BT8101)	MICROBIOLOGY
OPTIMIZATION IN MARITIME TRANSPORTATION (IØ8409)	ENGINEERING
SEABED BOUNDARY LAYER FLOW (MR8304)	ENGINEERING
STOCHASTIC METHODS APPLIED IN NONLINEAR ANALYSIS... (MR8207)	MATHS
THEORY OF MARINE DESIGN (MR8100)	ENGINEERING
TOPICS IN FISHERIES AND AQUACULTURE CYBERNETICS... (TK8108)	FISHERIES

For a full overview of the available courses, we would like to refer the reader of this report to the website <http://aquatnet.djangofoo.com/courses/search/phd/> .

4. PhD portal content: categorisation of courses

The portal aims at providing information to students on courses available on very specific topics. So it has been tried to avoid introducing generic courses into the portal, as these are more likely to be available at the institute of the PhD candidate.

Yet it is clear that there is no sharp borderline between generic and dedicated/specialized courses.

For instance , we may assume that several universities deliver generic courses on topics as:

- mathematic modelling
- statistic
- water chemistry
- electron microscopy
- bioinformatic,

Below a series of examples are shown that could be listed under a category of courses that are neither generic nor specialized. For these types of courses there might still be interest from students not belonging to the “home institute” of these courses.

- INTRODUCTION TO MATHEMATICAL MODELLING IN BIOLOGY
- ORIENTATION ON MATHEMATICAL MODELLING IN BIOLOGY
- PHD COURSE INTRODUCTION TO ELECTRON MICROSCOPY
- PRACTICAL COURSE: INTRODUCTION BIOINFORMATICS
- QUANTITATIVE GENETICS, WITH A FOCUS ON SELECTION THEORY
- STATISTICS FOR THE LIFE SCIENCES
- ADVANCED AQUATIC CHEMISTRY (KJ8070)
- MARINE BIOCHEMISTRY

- STOCHASTIC METHODS APPLIED IN NONLINEAR ANALYSIS... (MR8207)
- working groups in research
- evolution and evo-devo
- biodiversity (assessment, protection and exploit)
- immunity

The remainder of the courses in the database is considered to be specific and could attract attention of PhD students from across institute and or countries.

In the area of marine sciences, the database contains the following courses:

- HYDRODYNAMIC ASPECTS OF MARINE STRUCTURES 1 (MR8300)
- HYDRODYNAMIC ASPECTS OF MARINE STRUCTURES 2 (MR8306)
- ADVANCED WATER AND WASTEWATER TREATMENT (VM8200)
- AQUATIC ECOPHYSIOLOGY (ZO8024)
- BIO OPTICAL PROPERTIES & PIGMENTATION IN PLANTS (BI8060)
- BIO OPTICAL PROPERTIES AND PIGMENTATION IN PLANTS and ALGAE AS A DYNAMIC ANALYSIS OF SLENDER MARINE STRUCTURES (MR8208)
- MARINE GEOTECHNICAL ENGINEERING (BA8301)
- SEABED BOUNDARY LAYER FLOW (MR8304)
- MARINE LIPIDS (BT8117)
- MICROBIAL ECOLOGY (BT8101)

In the area of fishery/aquaculture sciences, the following courses can be found.

- microbial biofilms and biofloc
- application of functional genomics, molecular sciences and proteomics in animal production including aquaculture
- assessment and minimization of impacts of aquaculture: case studies
- biodiversity models for the study of impacts on biodiversity
- recirculation aquaculture and biofilter management
- ACTIVE FISHING METHODS (MR8103)
- FISH SALTING (BT8112)
- LABORATORY ANIMAL SCIENCE FOR RESEARCHERS (NEVR8003)
- MARINE ACOUSTICS II (TT8305)
- OPTIMIZATION IN MARITIME TRANSPORTATION (IØ8409)
- TOPICS IN FISHERIES AND AQUACULTURE CYBERNETICS (TK8108)
- LABORATORY ANIMAL SCIENCE FOR RESEARCHERS (NEVR8003)

- cryobiology of aquatic organisms
- integrated multi-trophic aquaculture
- phytoplankton production
- recirculation aquaculture systems
- wastewater management
- zooplankton production

5. Domains that are covered and areas that could be further developed

By the WP2 working group it has been tried to group the courses listed in the portal in domains, as a first step in the needs analysis for new courses (see Table below)

Table : Categories of PhD courses available in the Aqua-tnet portal

Category	Number
AQUACULTURE	5
BIOLOGY	12
CHEMISTRY	2
ENGINEERING	9
ENVIRONMENT	3
FISHERIES	2
FOOD PROCESSING	1
GENERIC	1
IMMUNOLOGY	1
MATHS, STATIST and BIOINFORMATICS	5
MICROBIOLOGY	2
MOLECULAR AND OMICS	1
Total	42

This Table reveals that some domains are rather well covered at the European level, will others are not. For instance we think that there is room for dedicated courses in the area of disease, immunology, socio economics, management, GIS and human health.

At this point we would like to remind the reader of this report on the outcome of a questionnaire, organized among European PhD students, during the AquaTNET I project. There was an overall agreement among the students for generic courses, yet the wish list for specific courses was very long and reflected the personal research area of the student. This highlights that it is difficult to set up dedicated of courses in a local institute in order to accommodate for these needs and that an effort at the European level could be made to balance the demand/supply of up to date and dedicated courses.

The list of courses also highlight that there is a need for courses that operate on the borderline between disciplines, such a natural and social sciences. Students graduating with a natural sciences background, should be able to acquire an understanding on how their subject fits within the scope of the wider society. Training in the fields of social sciences as well as economics, to include environmental economics, cost-benefit analysis, trade-offs, would help with integration of the students' own field of expertise. Such kind of courses could help to increase the societal impact the ongoing research.

6. Joint degrees for PhD in Europe

There is a tendency in Europe to evolve in the direction of offering joint Master and PhD degrees. Such kind of degrees can offer to the student the possibility to become acquainted with ongoing research at various locations within Europe within a short period of time and hence become able to integrate the European-wide knowledge into their own research.

At the moment 3 joint PhD degrees have become recently available within the Aqua-tnet domain:

- MACOMA - Erasmus Mundus PhD in Marine and Coastal Management <http://www2.uca.es/serv/catedra-unesco/erasmusmundus/macoma/index.htm>
- MARES - Doctoral Programme in Marine Ecosystem Health and Conservation <http://www.mares-eu.org>
- SMART – Science for Management of Rivers and their Tidal Systems <http://www.riverscience.eu>

The joint PhD degree programs are rather new, and courses available through these programs are under development. Efforts could be launched to try to apply for new projects under the Erasmus Mundus program so that the Aqua-tnet domain would even be better covered by joint PhD programs. Alternatively it would be interesting to increase the visibility all courses that are being developed by these joint PhD programs, by for instance uploading them on the Aqua-tnet PhD portal.

7. Training trainers

The supervising role

The concept on the need of training for trainers has poorly penetrated into the operating procedures at European universities. Yet some examples are available.

In Italy no specific training exists for trainers (PhD supervisors), nevertheless, the coordinator of the PhD School (elected by colleagues and nominated by the Principal, following election results) supervises the trainers' activity in collaboration with the entire Council of the PhD professors of the School. A University Evaluation Council (ANVUR) elaborates yearly an evaluation report on the scientific & didactic activity of each teacher/trainer, as well as of the PhD courses activities and success. Trainers are scientists (researchers, associated professors and full professors) that built their careers by submitting their candidature for an advanced position, passing an exam constituted by a commission of 5 full professors elected from the country (one of which may be nominated from abroad). The exam consists of different kinds of procedures, depending on the aim of the candidature/position. After 3 years in the gained position, the scientific and didactic output of the candidate is examined by a National Commission and he/she may be confirmed in the role, or not.

In the UK and the Netherlands PhDs are awarded by academic institutions. Inexperienced scientists are normally required to have a joint supervisor on the team which would provide support and guidance in regards to supervisory matters. In addition, there are now short courses in place which provide information on a variety of matters, such as University guidelines, procedures and requirements, the role of the supervisor, how to be an effective supervisor, how to support PhD students with specific problems/issues, how to support students preparing their final thesis/oral examination, how to detect if their PhD students may need specific technical training, and so on. In principle any academic with a research background (with a PhD and with a research portfolio) can become a PhD supervisor. Their past experience, however, defines how much and what kind of training they may require when supervising a PhD student. Formal training of PhD supervisors is currently not compulsory but is encouraged and there are several opportunities for this to take place. It is possible that in the future this process will become increasingly formalised.

It is apparent that the situation across Europe, and even within countries, is not uniform. Whereas some academic institutions seem to have in place a more formalised process, where only full Professors can act as

PhD supervisors, in others that is not the case. It is now encouraged, however, that PhD supervisory teams are put into place, instead of students being supervised by only one researcher. This helps broadening the skills basis but does also support training young researchers as PhD supervisors, while on the job by guiding PhD students.

The PhD process management

In the UK the process of regulating and monitoring PhD progression is normally managed by the Graduate or Doctoral School (or similarly named department). The procedures normally include regular and well defined milestones where students need to submit a written report and often go through an oral discussion with at least one independent/external senior researcher (i.e. someone who is not part of the supervisory team and may either be internal or external to the University where the student is registered; this will depend on the University's own regulations). The project milestones may include submission of the following: project proposal, literature review, annual reports, etc, as well as delivery of internal seminars and/or posters. In addition, in certain academic institutions, that may be a requirement where the student registers initially for a lower degree (eg MPhil or MRes) and is then required to submit a report half-way through their studies, in which main results are presented and the case is made for future work and how it will lead to the award of a PhD. The student will then go through an oral with external panel members, where a conclusion will be reached regarding the student's future progression.

At Ghent University (Flanders, Belgium) the installation of Doctoral Schools now allows for a formalized system on a yearly basis for monitoring progress in the PhD studies. This includes a written report by the student on the progress in relation to the research and followed courses, an evaluation by the director of the doctoral school and the promoter and the formulation of an advice on how to proceed.

In the Netherlands graduate schools are implemented. They operate with supervision plans which specify frequency of supervision, and the sharing of responsibilities. Practical and functional level for implementation are stipulated, making sure that the needs of the students are served, but that there is room left for academic freedom of operation, limiting administrative load.

In Italy, at University of Insubria, the coordinator of the PhD School (elected by colleagues and nominated by the Principal, following election results) supervises the trainers' activity in collaboration with the entire Council of the PhD professors of the School. A University Evaluation Council (ANVUR) elaborates yearly an evaluation report on the scientific & didactic activity of each teacher/trainer, as well as of the PhD courses activities and success.

It is clear that a supporting structure (e.g. Doctoral schools) such as set up in some European universities might help young researchers to walk the learning curve of becoming a PhD supervisor. Hence these kinds of structures should be supported, however without becoming an administrative burden.