



IDENTIFYING DATA

Aquaculture

| | | | | |
|---------------------|---|-----------|------|------------|
| Subject | Aquaculture | | | |
| Code | V10G061V01310 | | | |
| Study programme | Grado en Ciencias del Mar | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Mandatory | 3rd | 2nd |
| Teaching language | Spanish | | | |
| Department | | | | |
| Coordinator | Rocha Valdes, Francisco Javier | | | |
| Lecturers | Rocha Valdes, Francisco Javier | | | |
| E-mail | frocha@uvigo.es | | | |
| Web | http://https://mar.uvigo.es/ | | | |
| General description | <p>This course aims to provide to the students with the knowledge, skills and abilities that enable their to conceive, design and carry out research projects in the field of aquaculture. At the same time, this matter allows the student to design, manage and control aquaculture farming facilities on land and sea.</p> <p>English Friendly subject: International students may request from the teachers:</p> <p>a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.</p> | | | |

Training and Learning Results

| | |
|------|---|
| Code | |
| A2 | Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study |
| A3 | Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues |
| A5 | Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy |
| B3 | Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory. |
| B4 | Manage, process and interpret the data and information obtained both in the field and in the laboratory. |
| C8 | Know the main pollutants, their causes and effects in the marine and coastal environment. |
| C11 | Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems. |
| D1 | Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems. |
| D5 | Sustainability and environmental commitment. Equitable, responsible and efficient use of resources. |

Expected results from this subject

| Expected results from this subject | Training and Learning Results | | | |
|---|-------------------------------|----|-----|----|
| Knowing the potentially cultivable marine species in the world | A3 | B3 | C11 | D1 |
| | | B4 | | D5 |
| Know the aquaculture installations in land and sea | A2 | B3 | C11 | D5 |
| Dominate the aquaculture auxiliary techniques (phytoplankton and zooplankton) and the culture technics of the main species that are cultivate now in Europe | A2 | B3 | | |
| | | B4 | | |
| Know the treatments for the water in the culture systems | A3 | B3 | C11 | D1 |
| | | | | D5 |
| Recognise and analyse problems and propose solution strategies | A2 | B3 | C11 | D1 |
| | A3 | B4 | | D5 |
| Identify and control problems of environmental impact and marine pollution caused by marine aquaculture | A2 | | C8 | D1 |
| | A3 | | | D5 |
| | A5 | | | |

| | | | | |
|--|----------|----------|-----|----------|
| Design, control and management of culture centres and recovery of marine endangered Species | A2 A5 | B3 B4 | C11 | D5 |
| Known the operational details of marine companies, recognise specific problems and propose solutions | A3 | | | D5 |
| Design, control and manage culture production plants | A2 | | | D1 D5 |
| Aquariology | A2 | B4 | | D1 |

Contents

Topic

| | |
|--------------------------------|---|
| INTRODUCTION | Objectives of aquaculture. History, current situation and perspectives in the world and in Spain. Types of cultivation: according to species and its stages, according to its characteristics. New farming systems. |
| SPECIES SELECTION CRITERIA | Introduction. Biological criteria (reproductive, productive and health characteristics). Commercial criteria (consumption and market). Cultured freshwater species. Farmed marine species. Potentially cultivable species. |
| FACILITIES | Types of Facilities. Water intake. Storage and settling tanks. Culture tank design. Pond designs for culture. Floating cages, rafts, long-line. Auxiliary equipment. |
| WATER QUALITY AND ITS CONTROL | Sea water as culture medium. Changes suffered by the water in the crop. Biological filtration. mechanical filtration. physical absorption. Disinfection. Decantation. Aeration. Water quality criteria for aquaculture. |
| FOOD AND NUTRITION | Introduction. Feeding modes (larval, juvenile and adult stages). Nutrient requirements (molluscs, crustaceans, fish). Types of feed used in aquaculture. Formulation of diets. |
| PHYTOPLANKTON CULTURE | Introduction. Optimal properties for the choice of a cultivable species of phytoplankton. physical requirements. Nutrient requirements. Culture media. Characteristics of growth in culture. Phytoplankton culture methods. |
| ZOOPLANKTON CULTURE | Introduction. Artemia culture: general characteristics, life cycle, culture methodology, use in aquaculture. Rotifera culture: general characteristics, life cycle, culture methodology, use in aquaculture. Other planktonic crustaceans used in aquaculture: Copepods, Cladocera. |
| MOLLUSKS FARMING | Clam culture: obtaining and transporting broodstock, conditioning and obtaining gametes, embryo culture, larval culture, natural seed capture, post-larvae culture, pre-growing, fattening. Differences in the cultivation of other species. Octopus culture: obtaining and transporting broodstock, conditioning and obtaining eggs, embryo culture, larval culture, post-larvae culture, fattening and production. |
| ECHINODERMS FARMING | Introduction. Hedgehog Cultivation: Conditioning of reproducers and obtaining spawns; embryonic and larval culture, culture of postlarvae, pre-fattening, fattening. Other echinoderms farmed in Aquaculture. |
| CRUSTACEAN FARMING | Shrimp culture: obtaining and transporting broodstock, conditioning and obtaining gametes, embryo culture, larval culture, post-larvae culture, pre-fattening, fattening. Cetaria and their characteristics. |
| FISH FARMING | Turbot culture: obtaining and transporting reproducers, conditioning and obtaining gametes, embryo culture, larval culture, weaning, pre-fattening, fattening. Bream culture: obtaining and transporting broodstock, conditioning and obtaining gametes, embryo culture, larval culture, weaning pre-fattening, fattening. Seabass farming: obtaining and transporting broodstock, conditioning and obtaining gametes, embryo culture, larval culture, weaning pre-fattening, fattening. Salmon farming: obtaining and transporting broodstock, conditioning and obtaining gametes, embryo culture, larval culture, weaning pre-fattening, fattening. |
| MACROALGAE FARMING | Introduction on the cultivation of macroalgae, advantages and characteristics. cultivated species. Culture systems and methodology. |
| DISEASES OF CULTIVATED SPECIES | Mortality. Prevention: vaccinations, disinfection and isolation of specimens. Treatments: medications, environmental manipulation, isolation and disposal. Animal examination. Viral diseases. Bacterial diseases. Fungal infections. Protozoan diseases. Metazoan diseases. |

Planning

| | Class hours | Hours outside the classroom | Total hours |
|----------------------|-------------|-----------------------------|-------------|
| Lecturing | 30 | 45 | 75 |
| Seminars | 7 | 14 | 21 |
| Laboratory practical | 15 | 15 | 30 |

| | | | |
|---|---|-----|------|
| Seminars | 2 | 0 | 2 |
| Studies excursion | 7 | 0 | 7 |
| Essay questions exam | 3 | 7.5 | 10.5 |
| Objective questions exam | 1 | 1.5 | 2.5 |
| Report of practices, practicum and external practices | 0 | 2 | 2 |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

| | Description |
|----------------------|--|
| Lecturing | Program contents will be explained through classes. During the sessions the students will encourage the realization of comments and questions for clarification of questions during class. For the classes preparation by the students, notes on each of the topics will be available on the platform Tem@ before classes begin. |
| Seminars | Each group will prepare a seminar topic related to aquaculture, which will be presented and discussed in groups. Similarly, each group should prepare a brief abstract on the subject matter to be placed on the platform Tem@. This abstract will be distributed among all students and will be evaluated in the test. |
| Laboratory practical | This is obligatory because it is an essential complement to the theoretical sessions. Laboratory practices will be used to explain the techniques of cultivation and laboratory culture. To take full advantage of these practices, the student will write a resume for each practice. Text will include all possible information about this activity, including the theoretical foundation, the purpose of practice and job description to be held. |
| Seminars | During the tutorials it will be discussed questions concerning any aspect of the subject. Moreover, as this matter is attended in the last year of the degree, this tutoring time may also be used by students to see career or incorporation into different graduate curricula related to aquaculture. |
| Studies excursion | It is planned to conduct two studio outputs, aimed at students to observe the practical application of knowledge taught in class. The outputs shall be performed: <ol style="list-style-type: none"> 1. Visit the farmed salmon in Cotobade (Pontevedra). 2. Site visit of the Galician Institute for Aquaculture Training of the Galician Government in the Island of Arousa. |

Personalized assistance

| Methodologies | Description |
|--------------------------|---|
| Seminars | These activities will be developed in small groups. Students can obtain help and guidance to guide them in the seminar preparation and learning process. These activities will be developed in person (by direct consultations in the classroom or during tutorials and consultation sessions in the teacher's office) or via email. |
| Seminars | These activities will be developed individually or in small groups. Its purpose will be to meet the needs and queries of students related to the study, topics related to the subject and correction of exams, providing guidance, support and motivation in the learning process. These activities will be developed in person or via email. The tutorials, both individual and group, will be held from Monday to Thursday from 11:30 to 12:30 a.m. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation |
| Tests | Description |
| Essay questions exam | For the preparation of the tests, students may consult questions or clarify aspects of the subject that are evaluated in the exam. The assistance will be developed in person (by direct consultations in the classroom or during tutorials and consultation sessions by the teacher in his office) or via email. Similarly, once the test has been completed, the students will have a consultation schedule and review of exams to solve doubts and make inquiries about the exam itself. |
| Objective questions exam | The tests will be developed weekly with the objective that the students prepare each week the subject that will be discussed during the sessions. For the preparation of the tests, students may consult questions or clarify aspects of the subject that will be evaluated in the exam. The assistance will be developed in person (by direct consultations in the classroom or during tutorials and consultation sessions by the teacher in his office) or via email. |

Assessment

| | Description | Qualification | Training and Learning Results |
|----------|---|---------------|-------------------------------|
| Seminars | Following the completion of the seminars, each student group must submit a summary report of the subject matter, which will be evaluated. A minimum of 5 will be required to approve. | 10 | A2 B4 D1 A3 D5 A5 |

| | | | |
|---|---|----|----------------------|
| Laboratory practical | Laboratory practices are considered an essential part of the subject. Practices will be evaluated by the attendance and assistance of students to them. Laboratory practices are an obligatory activity. | 5 | A5 B3 C8 B4 |
| Essay questions exam | There will be a long written test on the official date will be assessed on the knowledge gained throughout the course. This test will assess all the knowledge acquired in the course of the subject. The minimum grade to pass the exam will be 5 | 40 | A2 B4 C11 D5 A3 |
| Objective questions exam | There will be several quizzes, multiple choice, during the course of lectures. Since the objective of these tests is that students prepare in advance the subjects to be discussed, questions of each test will cover the topics that are being treated that week (including topics to be covered in that class or the next if they are part of issue). The minimum grade to pass the test will be 5. | 15 | A2 B3 D1 A3 B4 A5 |
| Report of practices, practicum and external practices | For the evaluation of practices is obligatory that each student prepare a written report on the implementation and results of laboratory practices, which will be evaluated. The minimum grade to approve the report will be 5. | 30 | A2 B3 D1 A3 B4 D5 A5 |

Other comments on the Evaluation

In order to pass the subject, each student **must approve** the evaluation of teaching (long answer test) and laboratory practices (attendance and practice report) **separately** (with a mark higher than 5).

In the case of laboratory practices, which are mandatory, failure to attend these practices that is not duly justified will mean the elimination of the option to take the second chance test. Obviously, if the student has attended the practices, but has not passed them, they will have the right to recover them through a job and attend the second chance test if necessary.

The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start.

In the case that the student takes the **second chance evaluation** (July test), the weekly test scores, laboratory practices and seminars will be saved for the estimation of the final qualification in the case that the student exceeds (with note on 5) the exam. If the student passes the second chance exam, the grade will account for 40% of the final grade.

The official calendar of the evaluation will be published in:

<http://mar.uvigo.es/alumnado/examenes/>

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

Sources of information

Basic Bibliography

Barnabe, G., **Bases biológicas y ecológicas de la acuicultura**, 1996,

Abalde, J. et al., **Microalgas: cultivo y aplicaciones**, 1995,

Fingerman, M. y R. Nagabhushanam, **Aquaculture**, 2000,

FAO, **Fichas de la FAO sobre acuicultura**, 2012,

Stickney, R., **Aquicultura. Texto introductorio**, 2016, ACRIBIA S.A., 2016

Complementary Bibliography

Costa-Pierce, B. A., **Ecological Aquaculture: the Evolution of the Blue Revolution**, 2003,

Xunta de Galicia - VV.AA., **Unidades didácticas de acuicultura**, 1991,

Beveridge, M, **Cage Aquaculture**, 2004,

Fernández Souto, B. y X.L. Rodríguez Villanueva, **Guía da piscicultura europea**, 2002,

Huguenin, J. E. y J. Colt, **Design and Operating Guide for Aquaculture Seawater Systems**, 2002,

Lee, D. O. y J. F. Wickings, **Cultivo de crustáceos**, 1996,

Southgate, P. et al., **Aquaculture: farming aquatic animals and plants**, 2012,

Stead, S. M. y L. Laird, **Handbook of Salmon farming**, 2001,

Wedmeyer, G. A., **Physiology of fish in intensive culture systems**, 1996,

Wedemeyer, G. A., **Fish Hatchery Management**, 2001,

Recommendations

Subjects that it is recommended to have taken before

Marine zoology/V10G061V01210
