



IDENTIFYING DATA

Aquaculture

Subject	Aquaculture			
Code	V10G061V01310			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Rocha Valdes, Francisco Javier			
Lecturers	Paredes Rosendo, Estefanía Rocha Valdes, Francisco Javier			
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Web				
General description	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.			

Competencies

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
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.
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.

Learning outcomes

Expected results from this subject	Training and Learning Results			
Knowing the potentially cultivable marine species in the world	A2 A3		C11	D1 D5
Know the aquaculture installations in land and sea	A2	B3		
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			D1 D5
Recognise and analyse problems and propose solution strategies	A2 A3	B3 B4	C11	D1 D5
Identify and control problems of environmental impact and marine pollution caused by marine aquaculture	A2			D5
Design, control and management of culture centres and recovery of marine endangered Species		B3 B4		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

Contents	
Topic	
INTRODUCTION	Aquaculture objectives. Current situation and prospects in the world and Spain. History. Types of aquaculture.
WATER QUALITY AND ITS CONTROL	Seawater as culture medium. Undergoes changes in water cultivation. Biological filtration. Mechanical filtration. Physical absorption. Disinfection. Decantation. Aeration. Water quality criteria for aquaculture.
FACILITIES	Water intake. Storage tanks and slop. Culture tank design. Designs for culture ponds. Floating rafts. Rafts. auxiliary Equipment
FOOD AND NUTRITION	Introduction. Food intake (larval, juvenile and adults). Nutritional requirements (molluscs, crustaceans, fish). types food used in aquaculture. Formulation of diets
SPECIES SELECTION CRITERIA	Introduction. Commercial criteria (consumption and market). Biological criteria (reproductive characteristics, production and health). Freshwater species cultured. Cultured marine species. species potentially cultivable
PHYTOPLANKTON CULTURE	Introduction. Optimum properties to the choice a culturable phytoplankton species. Physical requirements. Nutritional requirements. Culture media. Growth characteristics in culture. Culture phytoplankton methods
ZOOPLANKTON CULTURE	Introduction. Artemia culture: general characteristics, life cycle, culture methodology, employment in aquaculture. Rotifer culture: general characteristics, life cycle, culture methodology, employment in aquaculture. Other planktonic crustaceans used in aquaculture: copepods, cladocerans.
MOLLUSKS FARMING	Culture of <i>Ostrea edulis</i> : collection and transportation of broodstock, preparation and production of larvae, larval rearing, collection natural seeds, cultivation of post-larvae, pre-fattening, fattening. cultivation clams: gathering and transportation of players, conditioning and obtaining gametes, embryo culture, larval rearing, natural seed collection, growing post-larvae, pre-fattening, fattening. Cultivation of <i>Pecten maximus</i> : obtaining and transporting broodstock, Conditioning and obtaining gametes, embryo culture, larval rearing, natural seed collection, growing post-larvae, pre-fattening, fattening. Mussel farming: natural seed collection, fattening on rafts. Treatment plants. Potential species: octopus culture: obtaining and transporting players and conditioning. Embryo culture, larval rearing, juvenile collection and fattening.
CRUSTACEAN FARMING	Shrimp farming: gathering and transportation of spawners, conditioning and obtaining gametes, embryo culture, larval rearing, cultivation of post-larvae, pre-fattening, fattening. Lobster culture: obtaining and transporting players, conditioning, cultivation embryonic, larval rearing, cultivation of post-larvae, pre-fattening, fattening. Caetarias
FLAT FISH FARMING	Turbot culture: obtaining and transporting reproductive individuals, conditioning and obtaining gametes, embryo culture, larval rearing, nursery, pre-fattening, fattening. Cultivation of sole: obtaining and transporting reproductive individuals, conditioning and obtaining gametes, embryo culture, larval rearing, weaning pre-fattening, fattening.
GILTHEAD SEABREAM FARMING	Collection and transportation of spawners, conditioning and obtaining gametes, embryo culture, larval rearing, weaning pre-fattening, fattening
EUROPEAN SEABASS FARMING	Collection and transportation of reproductive individuals, conditioning and obtaining gametes, embryo culture, larval rearing, weaning pre-fattening, fattening.
SALMON FARMING	Collection and transportation of spawners, conditioning and obtaining gametes, embryo culture, larval rearing, weaning pre-fattening, fattening.
DISEASES OF CULTIVATED SPECIES	Mortality. Prevention, isolation, environmental manipulation and treatment. Examination of the animals. Viral diseases. Bacterial diseases. Fungal Infections. Protozoan diseases. Diseases caused by metazoans.
MACROALGAE FARMING	Introduction of seaweed farming, advantages and features. Cultivated species. Methodology.

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	They are 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 required to approve.	10	A2 B4 A3	D1 D5
Laboratory practical	Laboratory practics are considered an essential part of the subject. Practics will be evaluated by the attendance and assistance of students to them.	5	B3 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 A3	C11 D5
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
Report of practices, practicum and external practices	For the evaluation of practices each student must 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	B4	D1 D5

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 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 calification in the case that the student exceeds (with note on 5) the exam.

The official calendar of the evaluation will be published in:

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

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., **Acuicultura. 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 are recommended to be taken simultaneously

Marine and coastal management/V10G060V01704

Subjects that it is recommended to have taken before

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and in blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching methodologies maintained

In the event that the teaching has to be taught in a mixed or virtual way, the classes and activities of the seminars will be maintained following the established teaching plan, even when these cannot be done in person.

* Teaching methodologies modified

In the event that teaching must be done in a mixed way, with face-to-face and virtual classes, or exclusively virtual, the same teaching will be carried out in both cases. To this end, classes will be videotaped and made available to students for viewing. The resolution of doubts can be done at the same time of the class, either in the same classroom (face-to-face), through chat or requesting audio during the class (mixed or virtual teaching). Additionally, the FAITIC teledoaching platform will be enabled for the resolution of doubts and the students will be able to send emails to the teacher for the resolution of specific doubts.

In the case of teledoaching, classes will preferably take place through the Remote Campus of the University. If the type of internet connection at home, both for the students and the teacher, prevents the use of the remote campus, other video conferencing systems that work under those technological limitations will be sought, such as Skype or Zoom. Similarly, if the recorded class videos cannot be distributed to students from FAITIC, external cloud storage systems will be sought to store and download the videos.

In the case of the confinement, limitations to the displacement or in the number of people affect the accomplishment of the laboratory practices and the exits, several possible alternatives are contemplated. If possible, both the laboratory practices and the exits will be postponed to a date in which they can be carried out, this conditioned to the limitations of the teaching calendar and always within the current academic year. In the event that it is not possible to carry out one of these activities, priority will be given to carrying out laboratory practices. If it is impossible to carry out these activities in person, then the laboratory practices will be carried out virtually using real databases from previous practices.

* Non-attendance mechanisms for student attention (tutoring)

In case of non-classroom teaching or limitations that imply the convenience of not doing face-to-face tutoring, these will be carried out virtually through videoconferences in the Virtual Office of the Remote Campus of the University or, if there are problems with this system, using Skype or Zoom. At the same time, the doubts, questions or tutorials of the students can be made and answered by email.

* Modifications (if applicable) of the contents

Modifying the contents of the Aquaculture course is not contemplated. This, because if it were not possible to teach the entire content in class, it is considered that all the subjects of the Aquaculture course can be obtained from the class notes given by the teacher at FAITIC, as well as with the videos of the classes and the bibliography provided.

* Additional bibliography to facilitate self-learning

It is recommended to visit the FAO website and read the documents on Aquaculture corresponding to the species and techniques that appear in the program and lecture notes.

* Other modifications

No major modifications are contemplated in terms of the teaching methodology to be carried out.

=== ADAPTATION OF THE TESTS ===

* Tests already carried out and pending

Given that the subject of Aquaculture is evaluated through various types of tests that allow a continuous evaluation and without the excessive preponderance of any of them, it is not considered necessary to change the weight of the evaluation to be carried out, which would be:

Written Test: [Previous Weight 40%] [Proposed Weight 40%]

Test type tests: [Previous weight 15%] [Proposed Weight 15%]

Seminars: [Previous weight 10%] [Proposed Weight 10%]

Laboratory Practices: [Previous Weight 35%] [Proposed Weight 35%]

* Tests that are modified

Written Test: In the event that this test must be performed virtually and not in person, it will be done through the FAITIC Platform and Moodle. Its structure will change, giving greater importance to alternative or short answer answers instead of long development answers.

Test type tests: In the event that the type tests already carried out exceed 60% of the possible tests, these tests will be considered as completed. In the event that they could not be carried out in person, or if those carried out were less than 60%, these will be carried out through weekly questionnaires of alternatives in FAITIC.

* Additional Information

In any case, as in the case of face-to-face teaching, to pass the Aquaculture course, each student must have passed the written test of Theory and Practices separately (with a grade higher than 5.0).
