Sustainable Aquaculture Production Technologies (250590)

General Information

School	ETSECCPB
Departments	Departament d'Enginyeria Agroalimentària i Biotecnologia (DEAB)
Credits	6.0 ECTS
Programs	GRAU EN CIÈNCIES I TECNOLOGIES DEL MAR (pla 2018) GRAU EN ENGINYERIA AMBIENTAL (pla 2020)
Course	2025/26

Main teaching language at each group

- Group 11Q1 Spanish (Q1)
- Group 12Q1 Spanish (Q1)

Faculty

Responsible Faculty: Olga Maria Felip Arias
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Objectives of Education

This course will show students technological solutions for the sustainable, economic, social, and environmental development of aquaculture. Emphasis will be placed on different cultivation systems (level of intensity, resource use) and the specificities of the different stages of the production cycle (hatchery, nursery, grow-out), highlighting the main differences between groups of fish species. Mollusk, crustacean, and algae production technology will also be reviewed, and the criteria for the introduction of new cultured species will be analyzed. Special emphasis will be placed on the relationship between farming systems and their environment, to assess the environmental load associated with aquaculture activity, identifying and quantifying both the use of materials and energy as well as waste production, and thus implement environmental improvement strategies.

Know the various groups of vertebrates of interest for aquaculture and their biology.
Understand the adaptive mechanisms of aquatic species and their implications for production.
Understand and know how to apply to production the fundamentals and dynamics of the main environmental parameters that affect vertebrate physiology.

This subject is oriented towards the application of observation technologies, remote sensing and automatic exploration of the marine environment, which is essential for monitoring coastal water bodies and obtaining the necessary data to control almost all human activities in the marine environment related to the exploitation of natural and aquaculture resources in the marine and coastal environment.

Upon completing the subject on Sustainable Aquaculture Production Technologies, the student should be able to describe the characteristics of the aquaculture sector and identify its various applications.

The student will be able to identify the elements that make a given species interesting for aquaculture, understand its biological characteristics and its implications for production. They will be able to understand the determinants of production in aquatic environments, and define the main water quality parameters relevant to production, understand their dynamics as well as their interactions, and understand the adaptive mechanisms of aquatic species and their implications for production. They will be able to describe suitable facilities for the production of aquatic organisms. Finally, they will be able to use appropriate technical management criteria for the production of aquatic organisms that consider organism welfare and

environmental sustainability. Technical management of cultivation is addressed in two main groups, distinguishing between organisms that require exogenous feeding (fish and crustaceans) and those that can feed directly from the environment (mollusks and algae).

Competencies

Especific

To know and apply the lexicon and concepts of the Marine Sciences and Technologies and other related fields.
Establish a good practice in the integration of common numerical, laboratory and field techniques in the analysis of any problem related to the marine environment.
To set, evaluate and propose solutions to the different conflicts of use and exploitation in the marine and coastal environment resources based on scientific and technical criteria.
Apply the state-of-the-art numerical and statisticat techniques in the coastal and marine fields for a correctly interpretation of data. (Specific competence of the Marine Technologies Mention)
Use and apply indicators to assess impacts, both natural and anthropogenic, and propose corrective measures with monitoring and surveillance programs. (Specific competence of the Marine Technologies Mention)
Develop a conceptual framework to address the sustainability of the marine environment and the related socio-economic activities at different scales, explaining the effects of climate change.
Set, plan and execute basic and applied research in the field of Marine Sciences and Technologies.
Carry out calculations, assessments, surveys and inspections in coastal and marine environments, as well as the corresponding technical documents.
Write technical reports and disseminate knowledge about the different components of the marine system, considering the applicable legal framework.
Apply the necessary tools to analyze the economic and legal aspects of human actions and the related impacts on the marine environment, including technical advice and representation of companies and administrations.

Generic

Apply knowledge and academic experience to the control and monitoring of the marine environment and its coastal boundary, using the state-of-the-art tools in the Marine Sciences and Technologies.
Encompass and teach studies in the different research lines that converge in Marine Sciences and Technologies.
Combining preservation with economic activity within the framework of current legislation promoting the development of a social and environmental awareness.

Total hours of student work

		Hours	Percentage
Supervised Learning	Large group	43.98 h	73.37 %
	Medium group	7.98 h	13.31 %
	Laboratory classes	7.98 h	13.31 %
	Guided Activities	0.0 h	0.00 %
Self Study		90.06 h	

Contents

1. Presentation of the subject

Presentation of the basic objectives of the subject, the topics, the methodology and the evaluation system, as well as the teachers who will participate in it.

Specific Objectives

Understanding the structure of the subject and the objectives to be pursued is a basic tool to achieve the involvement of students in it.

2. Aquaculture systems

The term aquaculture will be deepened, reviewing the groups of cultured organisms. The types of possible systems for production are defined and the pros and cons are stated at the level of economic and environmental sustainability.
Dissection of organisms of interest for aquaculture production

Contingut Lab

Laboratory practice: Dissection of organisms of interest for aquaculture production. This session will take place in the Animal Production laboratory of the EEABB. It will last 2 hours, and subsequently the students will have one week to upload the practice document to the virtual campus ATENEA so that it can be assessed. Practice objective: Learn the differences between the digestive systems of carnivorous and herbivorous fish and relate the physiology of the digestive system with the lifestyle of these organisms and the implications this has in aquaculture production.

Specific Objectives

Recall basic concepts of aquaculture and relate the concepts of aquaculture and sustainability
Understand their physiology and commercial interest

3. Extensive aquaculture facilities

Description of the tools and facilities necessary for extensive aquaculture production in algae, molluscs and fish.
Determination of the physico-chemical characteristics of the aquatic environment in production conditions

Contingut Lab

Laboratory practice: Indirect study of metabolism from oxygen consumption in fish. This session will take place in the Animal Production laboratory of the EEABB. It will last 2 hours, and subsequently the students will have one week to upload the practice document to the virtual campus ATENEA so that it can be assessed. Practice objective: Learn an indirect method of measuring fish metabolism, such as oxygen consumption, and understand the variations of this parameter according to temperature, as a physiological adaptation to a changing environment.

Specific Objectives

Place students within extensive facilities, deepening their management and continuous innovation.
To know the quality of the water to be able to define the existing conditions of crop and situate them inside the spectrum of the sustainability and the viability

4. Intensive aquaculture facilities

Description of the tools and facilities necessary for intensive aquaculture production in algae and fish.
Design of a facility suitable for extensive or intensive aquaculture

Contingut Lab

Classroom assignment: Design of a suitable facility for intensive aquaculture working on the necessary flow calculations for the facility.

Specific Objectives

Place students within intensive facilities, deepening their management, sustainability and continuous innovation.
Know the equipment and design criteria of an aquaculture company

5. Nutrition and feeding in aquaculture

Aquatic animal nutrition concepts, nutritional requirements. Types of existing feed in aquaculture according to the organism cultivated, feed formulation, machinery associated with the production and administration of feed. Sustainable alternatives in food.
Simple formulation of aquaculture feed according to the nutritional, organoleptic and technological requirements of the species
Programming of an aquaculture installation taking into account the productive, environmental and economic parameters

Contingut Lab

Classroom assignment (case study): programming of an aquaculture facility considering productive, environmental, and economic parameters. This activity will be developed over several sessions and must be presented orally at the end of the course.

Specific Objectives

Introduce food into aquaculture as the main economic cost within production and an element with the greatest environmental impact. This requires introducing basic concepts of nutrition and food production technology. Look for sustainable alternatives and arouse interest in students about the importance of innovating in this area.
Apply the knowledge of nutrition and food in the practical definition of a feed for aquaculture
Apply the acquired knowledge of production technology developing a case study

6. Reproduction technology: algae, mollusks, crustacean

Introduction to the life cycle of different organisms (plants and invertebrates) of aquaculture interest and how these organisms reproduce under production conditions.

Specific Objectives

To deepen the biological knowledge of the students and place them within the initial phases of aquaculture production.

7. Reproduction technology: fish

Introduction to the life cycle of different organisms (vertebrates) of aquaculture interest and how these organisms reproduce under production conditions

Specific Objectives

To deepen the biological knowledge of the students and place them within the initial phases of aquaculture production.

8. Health and disease management

Health concept in production facilities. Well-being and stress as prevention elements. Health and pathology indicators in aquaculture. Main diseases in aquaculture, losses caused by pathologies and proper management of these (mollusks, algae, crustaceans and fish).

Contingut Lab

Classroom activity: Bibliographic search of diseases that have caused losses in aquaculture. Choice and justification of the most appropriate treatment.

Specific Objectives

Know the elements that contribute to maintaining health in aquaculture. Knowing the diseases that produce the greatest economic losses in aquaculture, learning how to diagnose and remedy them correctly.
Practical application in a case study of the knowledge acquired on health and disease in aquaculture

9. Environmental impact: types and actions

List the factors of aquaculture production that have an impact on the environment, delve into the consequences of the productive activity and the possible current and future improvements within the sector to increase sustainability

Contingut Lab

Classroom activity: Discussion seminar on fishing vs. aquaculture paradigm.

Specific Objectives

Make students aware of the impacts caused by aquaculture and the importance of correct production management
Collect and value all the knowledge acquired in the subject

10. Evaluation

The assessment calendar and grading method will be approved before the start of the course.
The grade for the course is obtained from continuous assessment scores, assessment tests (midterm and final), and the corresponding laboratory practices, seminars, and/or computer lab work.
Continuous assessment consists of performing different activities, both individual and group, additive and formative in nature, carried out during the course (inside and outside the classroom).
The grade for practical instruction is the average of lab activities, seminars, and computer lab work.

See 'Grading method' section.

Teaching Methodology

Weekly theoretical classes and practical sessions will be held, including laboratory activities, bio-programming or seminars, up to a total of 4 hours per week. All practical sessions will be assessed and are mandatory, except for justified force majeure.
The detailed course schedule will be provided in the first session.
Support materials related to the detailed syllabus in the course guide will be used via the ATENEA virtual campus: content, programming of evaluation and guided learning activities, and bibliography.
Although most sessions will be taught in the language indicated in the guide, some sessions involving guest experts may be conducted in another language.
To perform lab practices, you must have the following personal protective equipment (PPE):

- UPC white lab coat

Grading Rules

(*) The evaluation calendar and grading rules will be approved before the start of the course.

The assessment calendar and grading method will be approved before the start of the course.
The grade for the course is obtained from continuous assessment scores, assessment tests (midterm and final), and the corresponding laboratory practices, seminars, and/or computer lab work.
Continuous assessment consists of performing different activities, both individual and group, additive and formative in nature, carried out during the course (inside and outside the classroom).
The grade for practical instruction is the average of lab activities, seminars, and computer lab work.
This course will include continuous assessment linked to the following teaching methodologies:
TYPE OF LEARNING EVALUATION METHOD % OF FINAL GRADE
Theoretical classes Exams based on theoretical topics 50 (Midterm 20%, Final 30%)
Case-based learning Assessable classroom activities 10%
Guided laboratory practices Evaluation of practice result reports 10%
Project-based learning and case study Final project and defense, bioprogramming and flow calculations 30%
TOTAL 100%

The assessment tests consist of two exams (midterm and final), laboratory practices, seminars, and bio-programming. The characteristics of the assessment tests are explained in class. In general, they consist of a section with T/F questions and another with short questions and applied exercises on concepts related to the course's learning objectives in terms of knowledge or understanding.

Test Rules

Students who fail the regular evaluation and have participated regularly in the failed evaluation tests will have the option to take a reassessment exam during the period set in the academic calendar. Students who have already passed or did not attend one of the assessable tests may not take it. Extraordinary assessments will be conducted for students who, for justified force majeure, could not carry out some of the continuous evaluation tests.

These tests must be authorised by the relevant program coordinator, at the request of the course coordinator, and will be carried out within the corresponding academic period.

Office Hours

The hours of attention to students will be defined according to the schedules of the subject. In any case, a personalized attention session could always be requested, by writing the teacher involved, by email.

Bibliography

Basic

- Barnabé, G. Aquaculture: biology and ecology of cultured species. Boca Raton, FL: Taylor & Francis, 1994. ISBN 9780429217654.
- Beveridge, M. Cage aquaculture. 3rd ed. Oxford: Blackwell, 2007. ISBN 9780470995761.
- Belaud, A. Oxygénation de l'eau: en aquaculture intensive. Toulouse: Cépaduès-Éditions, 1995. ISBN 2854283503.
- Lawson, T.B. Fundamentals of aquacultural engineering. New York: Chapman & Hall, 1995. ISBN 0412065118.
- Midlen, A.B. Environmental management for aquaculture. London, UK: Chapman & Hall, 1998. ISBN 0412595001.
- Timmons, M.B. Aquaculture water reuse systems: engineering design and management. Amsterdam, The Netherlands: Elsevier, 1994. ISBN 044489585X.

Resources

"There will be weekly theoretical classes and practical sessions including laboratory activities, bioprogramming or seminars, up to a total of 4 hours per week. All practical sessions will be evaluated and mandatory, except for reasons of force majeure justified.

The detailed calendar of the subject will be provided in the first session of the same.

Support material related to the syllabus detailed in the teaching guide will be used through the ATENEA virtual campus: contents, programming of assessment and directed learning activities and bibliography.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

To do the laboratory practices you need the following personal protective equipment (PPE):
* White lab coat UPC Chemical
You can buy them at UPC Shop (upc-shop.com) or any specialty store."