



Information about the subject

Degree: Bachelor of Science Degree in Veterinary Medicine

Faculty: Faculty of Veterinary Medicine and Experimental Sciences

Code: 1260401 **Name:** Aquaculture

Credits: 6,00 **ECTS Year:** 4 **Semester:** 2

Module: Module of Animal Production

Subject Matter: Animal Production **Type:** Compulsory

Department: Animal Production and Public Health

Type of learning: Classroom-based learning

Languages in which it is taught: Spanish

Lecturer/-s:

1264A [Jeronimo Chirivella Martorell](#) (**Responsible Lecturer**) jeronimo.chirivella@ucv.es



Module organization

Module of Animal Production

| Subject Matter | ECTS | Subject | ECTS | Year/semester |
|-------------------|-------|---|------|---------------|
| Animal Production | 30,00 | Animal production and genetic improvement I | 6,00 | 4/1 |
| | | Animal production and genetic improvement II | 6,00 | 4/2 |
| | | Aquaculture | 6,00 | 4/2 |
| | | Economy and Business in the veterinarian domain | 6,00 | 3/2 |
| | | Nutrition and animal feeding | 6,00 | 4/1 |



Learning outcomes

At the end of the course, the student must be able to prove that he/she has acquired the following learning outcomes:

- R1 The student identifies the main aquaculture productions and knows how and where they are produced.
- R2 The student knows the zootechnical fundamentals of captive production of aquatic organisms.
- R3 The student knows and applies the principles of aquaculture engineering to the design and operation of aquaculture facilities.
- R4 The student recognises the environmental and socio-economic implications of aquaculture.
- R5 The student elaborates breeding plans for aquaculture facilities.
- R6 The student manages small-scale marine crops.
- R7 The student produces reports and makes valid judgements on various aspects of the study of aquaculture.
- R8 The student connects the theoretical and practical contents through projects and assignments.
- R9 The student understands conceptually and values the importance of the study of aquaculture in the context of present-day science and society, and of veterinary medicine in particular.



Competencies

Depending on the learning outcomes, the competencies to which the subject contributes are (please score from 1 to 4, being 4 the highest score):

| BASIC | | Weighting | | | |
|---------|--|-----------|---|---|---|
| | | 1 | 2 | 3 | 4 |
| CB2 | Capacity to apply knowledge to work or occupation in a professional way and have the competences that are proved by preparing and arguing topics and problem-solving in their specific field of study. | | | | X |
| CB3 | Capacity to gather and interpret relevant data usually within their specific field of study and capacity to make judgments that include reflection on relevant social, scientific or ethical issues. | | | | X |
| CB4 | Capacity to communicate information, ideas, problems and solutions at specialist and non-specialist levels. | | | | X |
| CB5 | Capacity to develop those learning skills needed to undertake further studies with a high degree of autonomy. | | | | X |
| GENERAL | | Weighting | | | |
| | | 1 | 2 | 3 | 4 |
| CG0 | Capacity to speak well in public. | | X | | |
| CG3 | Understanding and applying control of animal breeding, management, health, reproduction, protection, and feed as well as improving production. | | | | X |
| CG4 | Understanding and applying methods and processes for obtaining efficient animal products under optimal conditions and costs, and assessing environmental impacts. | | | | X |
| CG5 | Understanding and applying laws, regulations and administrative provisions in all areas of the veterinary profession and public health, understanding the ethical implications of health in a changing global context. | | | | X |
| CG6 | Developing professional practice, acquiring skills related to teamwork, with an efficient use of resources and quality management. | | | | X |



CG7 Identifying emerging risks in all areas of the veterinary profession.

X

| SPECIFIC | | Weighting | | | |
|-------------|---|-----------|---|---|---|
| | | 1 | 2 | 3 | 4 |
| E44 | Knowing and applying the basics of animal production: traditional and modern systems. | | | | X |
| E45 | Knowing and applying raw materials for animal feeding: characteristics, production and preservation. | | X | | |
| E46 | Knowing and applying the basics of animal nutrition, ration formulation and feed manufacturing. | | X | | |
| E49 | Knowing and applying genetics to health improvement programs. | | X | | |
| E50 | Knowing and applying strategies and procedures to output. | | | | X |
| E51 | Knowing and applying the fundamentals of livestock facilities and environmental hygiene. | | | | X |
| E52 | Knowing and applying the principles of production and marketing process. | | | X | |
| E53 | Knowing and applying sustainable development. | | | | X |
| E54 | Knowing and applying aquaculture. | | | | X |
| TRANSVERSAL | | Weighting | | | |
| | | 1 | 2 | 3 | 4 |
| T1 | Capacity of analysis, synthesis, implementation of knowledge for problem-solving and decision-making. | | | | X |
| T2 | Understanding and applying the scientific method to professional practice including evidence-based medicine. | | | | X |
| T3 | Basic knowledge of the veterinary profession: legal, economic, administrative, planning and time management issues and the veterinarians' society together with the importance of monitoring quality, standardization and protocols of veterinary practice. | X | | | |



| | | | | | |
|-----|---|--|--|---|---|
| T4 | Mastering fluency in oral and written mother tongue communication, listening and responding effectively using a language appropriate to audience and context. | | | | X |
| T6 | Using information technology to communicate, share, search for, collect, analyze and manage information, especially related to the veterinarian practice. | | | X | |
| T7 | Ability to adapt to new situations, self-critical ability, being aware of personal limitations and understanding when and where seeking and obtaining advice and professional help. | | | | X |
| T8 | Efficient and effective work, both independently and as a member of a multidisciplinary team or unit, showing respect, appreciation and sensitivity to the work of others. | | | X | |
| T9 | Keeping an ethical behaviour in the exercise of given responsibilities toward the profession and society. | | | X | |
| T10 | Ability to learn, to research, and to be aware of the need to keep knowledge updated, and attending training programs. | | | | X |



Assessment system for the acquisition of competencies and grading system

| Assessed learning outcomes | Granted percentage | Assessment method |
|----------------------------|--------------------|--|
| | 55,00% | Written assessment of acquired knowledge and skills. The test may consist of a series of open-ended questions or multiple-choice questions about the theoretical contents of the module and/or practical exercises (problem-solving). |
| | 10,00% | Evaluation of the use of the practical lessons in the classroom, of problems or computer science, seminars and tutorials, by means of participation, computer-supported problem solving and the elaboration of the corresponding reports. |
| | 15,00% | Evaluation of the practical laboratory work, which must demonstrate the competences acquired by the student and his or her ability to use them to solve the different situations and problems that arise in a laboratory; this assessment may consist of one of the following methods, or a combination of several of them: an individual written test, the individual or group performance of a laboratory experience, the delivery of an individual or group report on the work carried out in the laboratory. |
| | 10,00% | Evaluation of group work through a system of continuous assessment throughout the course based on the delivery of assignments the objectives and content of which will be proposed by the teacher. |
| | 10,00% | Evaluation of activities in which the student must do some research individually and structure information related to each of the topics through a system of continuous assessment throughout the course based on the delivery of papers, the objectives and contents of which will be proposed by the teacher. |



Observations

* In order to pass the subject the student must pass every assessment test and activity separately.

MENTION OF DISTINCTION:

In accordance with the regulations governing the assessment and grading of subjects in force at UCV, the distinction of "Matrícula de Honor" (Honours with Distinction) may be awarded to students who have achieved a grade of 9.0 or higher. The number of "Matrículas de Honor" (Honours with Distinction) may not exceed five percent of the students enrolled in the group for the corresponding academic year, unless the number of enrolled students is fewer than 20, in which case a single "Matrícula de Honor" (Honours with 9 Distinction) may be awarded. Exceptionally, these distinctions may be assigned globally across different groups of the same subject. Nevertheless, the total number of distinctions awarded will be the same as if they were assigned by group, but they may be distributed among all students based on a common criterion, regardless of the group to which they belong. The criteria for awarding "Matrícula de Honor" (Honours with Distinction) will be determined according to the guidelines stipulated by the professor responsible for the course, as detailed in the "Observations" section of the evaluation system in the course guide.

Learning activities

The following methodologies will be used so that the students can achieve the learning outcomes of the subject:

- M1 On-site training activity aimed primarily at acquiring knowledge acquisition skills. It is characterised by the fact that students are spoken to. Also called master class or exposition, it refers to the oral presentation made by the teacher, (with the support of blackboard, a computer and a projector for the display of texts, graphs, etc.), in front of a group of students. They are expository, explanatory or demonstrative sessions of contents. The size of the group is determined by the limit or physical capacity of the classroom; therefore, it is a single group.
- M2 On-site training activity aimed primarily at obtaining knowledge application and research skills. Knowledge is built through interaction and activities. The activity consists of supervised monographic sessions with shared participation (teachers, students, experts). The size of the group is variable, from one large group to various small groups, with a minimum of 6 students to ensure interaction. The evaluation will be based on follow-up records kept by the teacher. Participation and the development of the capacity to problematize should be taken into account.



- M3 On-site group-work training activity oriented toward problem solving under the supervision of a teacher. It would correspond to "Animal-free supervised practical work", type e1, from the European evaluation of EAEVE. The size of the group is variable, in a range of 10 to 20 students, to differentiate it from a master class.
- M4 On-site training activity in groups that takes place in the classroom. It includes working with documents and formulating ideas without handling animals, organs, objects, products, or corpses (e.g., work with articles or documents, clinical case studies, diagnostic analyses, etc.). It would correspond to "Animal-free supervised practical work", type e1, from the European evaluation of EAEVE. The size of the group is variable, in a range of 10 to 20 students.
- M5 On-site training activity in groups that takes place in the Computer Lab where the computer is used as support for learning. It includes work with computer models, specific software, Web queries, etc. It would correspond to "Animal-free supervised practical work", type e1, from the European evaluation of EAEVE. The size of the group is variable, in a range of 10 to 20 students.
- M6 On-site training activity in groups carried out in the laboratory. It includes the sessions where the students develop laboratory experiments, make dissections or use the microscopes for the study of histological or histopathological samples actively and autonomously, under the supervision of the professor. It also includes work with healthy animals, objects, products, corpses (e.g., animal handling, bacteriological practices, physiology or biochemistry, meat inspection, etc.). It would correspond to the "Supervised practical non-clinical animal work" type e2 of the European evaluation of EAEVE. The size of the group is variable, in a range of 10 to 20 students.
- M7 On-site training activity that is defined as the clinical practical work developed in the Veterinary Clinical Hospital or clinical centres ascribed to the University, as well as itinerant clinical practices, mainly with ruminants, equids, pigs, birds and aquatic animals. Also included are necropsies, surgical workshops and training in clinical examination techniques or diagnosis with healthy patients. In these practical sessions the student will always work with animals, which can be healthy (e.g. propaedeutic or obstetrics) or clinical cases (individual or collective), including a protocol or work scheme, being supervised by a teacher and assuming the provision of a service. This type of training corresponds to type e3 of the EAEVE European evaluation called "Clinical Training" (strickly hands-on)". The size of the group will be 5 students or fewer.
- M8 A set of on-site training activities carried out by the teacher to provide personalised attention to the student or in small groups with the aim of reviewing and discussing the materials and topics presented in classes, seminars, readings, carrying out projects, etc. The aim is to ensure a truly comprehensive education of the student rather than a mere transfer of information. It is, therefore, a personalized assistance relationship in which the tutor assists, facilitates and guides one or more students in the learning process.



- M9 Set of processes that attempt to evaluate the learning outcomes of students expressed in terms of acquired knowledge, capacities, skills or abilities developed and manifested attitudes. It covers a wide range of activities that can be developed for students to demonstrate their training (e.g. written, oral and practical tests, projects or assignments). It also includes the Official Calls.
- M10 Autonomous training activity, including activities and coursework, bibliographic searches. The results obtained from unsupervised group and teamwork will be evaluated, with particular attention paid at the time of evaluation to the acquisition of specific knowledge development skills through group work.
- M11 Autonomous training activities related to personal study, or the preparation of individual course assignments. The individual preparation of readings, essays, problem solving, papers, reports, etc. will be evaluated through presentations or submissions during theoretical classes, practical classes, seminars and/or tutorials. The evaluation of the submitted papers will consider the structure of the paper, the quality of the documentation, originality, spelling and presentation.



IN-CLASS LEARNING ACTIVITIES

| | LEARNING OUTCOMES | HOURS | ECTS |
|-----------------------------------|---------------------------------------|--------------|-------------|
| Theoretical lessons (TL) M1 | R1, R2, R3, R4, R9 | 30,00 | 1,20 |
| Seminars (S) M2 | R1, R2, R3, R4, R7, R9 | 4,00 | 0,16 |
| In-Classroom Practice (ICP) M4 | R1, R5, R7, R8, R9 | 2,00 | 0,08 |
| Computer Practice (CoP) M5 | R2, R5, R7, R8, R9 | 12,00 | 0,48 |
| Laboratory Practice (LP) M6 | R6, R7, R8, R9 | 8,00 | 0,32 |
| Tutorial M8 | R1, R2, R3, R4, R5, R6, R7, R8, R9 | 2,00 | 0,08 |
| Evaluation (Ev) M9 | R1, R2, R3, R4, R7, R9 | 2,00 | 0,08 |
| TOTAL | | 60,00 | 2,40 |

LEARNING ACTIVITIES OF AUTONOMOUS WORK

| | LEARNING OUTCOMES | HOURS | ECTS |
|------------------------|---------------------------------------|--------------|-------------|
| Group work M10 | R1, R2, R5, R7, R8, R9 | 20,00 | 0,80 |
| Individual work M11 | R1, R2, R3, R4, R5, R6, R7, R8, R9 | 70,00 | 2,80 |
| TOTAL | | 90,00 | 3,60 |



Description of the contents

Description of the necessary contents to acquire the learning outcomes.

Theoretical contents:

| Content block | Contents |
|---|---|
| DIDACTIC UNIT I: INTRODUCING AQUACULTURE | Chapter 1. Introduction: definition and concept; goals; production systems; state-of-art and prospects. |
| DIDACTIC UNIT II: BIOLOGICAL AND ZOO-TECHNICAL PRINCIPLES FOR FINFISH AQUACULTURE | Chapter 2: Aquaculture nutrition: feeding behavior; nutritional and energetic requirements. Chapter 3: Aquaculture feeding I: assistant cultures: microalgae. Chapter 4: Aquaculture feeding II: assistant cultures: rotifer. Chapter 5: Aquaculture feeding III: assistant cultures: brine shrimp. Chapter 6: Aquaculture feeding IV: artificial diets. Chapter 7: Finfish reproduction in aquaculture. Chapter 8: Larval rearing in finfish. Chapter 9: Farming finfish: pre-on-growing and on-growing |
| DIDACTIC UNIT III: AQUACULTURE ENGINEERING PRINCIPLES | Chapter 10: Water as living support for aquaculture. Chapter 11: Design and management of land-based fish farms; requirements, supplying and treatment of water. Chapter 12: Design and management of sea cages. |
| DIDACTIC UNIT IV: AQUACULTURE AS SUSTAINABLE ECONOMIC ACTIVITY | Chapter 13: Aquaculture and environment interaction. |



Organization of the practical activities:

| | Content | Place | Hours |
|------|--|-----------------|-------|
| PR1. | Production models for aquaculture farms | Computer | 12,00 |
| PR2. | Small-scale marine cultures management | Laboratory | 8,00 |
| PR3. | Technical visit to a land-based fish farm. | Technical visit | 2,00 |
| PR4. | Technical visit to an off-shore fish farm. | Technical visit | 2,00 |

Temporary organization of learning:

| Block of content | Number of sessions | Hours |
|---|--------------------|-------|
| DIDACTIC UNIT I: INTRODUCING AQUACULTURE | 2,00 | 4,00 |
| DIDACTIC UNIT II: BIOLOGICAL AND ZOO-TECHNICAL PRINCIPLES FOR FINFISH AQUACULTURE | 19,00 | 38,00 |
| DIDACTIC UNIT III: AQUACULTURE ENGINEERING PRINCIPLES | 8,00 | 16,00 |
| DIDACTIC UNIT IV: AQUACULTURE AS SUSTAINABLE ECONOMIC ACTIVITY | 1,00 | 2,00 |



References

AQUACULTURE TEXTBOOKS:

BARNABÉ, G. Y OTROS COLABORADORES. BASES BIOLÓGICAS Y ECOLÓGICAS DE LA ACUICULTURA. ACRIBIA 1996

BROWN, L. ACUICULTURA PARA VETERINARIOS. ACRIBIA 2000

JOHN S. LUCAS, PAUL C. SOUTHGATE. AQUACULTURE: FARMING AQUATIC ANIMALS AND PLANTS, 2nd Edition, Wiley-Blackwell January 2012.

FISH FARMING AND FISH MANAGEMENT:

AMOS RICHMOND, QIANG HU. HANDBOOK OF MICROALGAL CULTURE: APPLIED PHYCOLOGY AND BIOTECHNOLOGY, 2nd Edition. Wiley-Blackwell 2013.

FELICITY HUNTINGFORD, MALCOLM JOBLING, SUNIL KADRI.(EDITORS). AQUACULTURE AND BEHAVIOR. Wiley-Blackwell 2012.

LINDSAY G. ROSS, BARBARA ROSS. ANAESTHETIC AND SEDATIVE TECHNIQUES FOR AQUATIC ANIMALS, 3rd Edition. Wiley-Blackwell 2008.

MICHALIS PAVLIDIS (EDITOR), CONSTANTINOS MYLONAS (EDITOR). SPARIDAE: BIOLOGY AND AQUACULTURE OF GILTHEAD SEA BREAM AND OTHER SPECIES. Wiley-Blackwell 2011.

MORETTI, A., PEDINI, M., CITTOLIN, G Y GUIDASTRI, R. MANUAL ON HATCHERY PRODUCTION OF SEABASS AND GILTHEAD SEABREAM. Vol. I. FAO (1999).

MORETTI, A., PEDINI, M., CITTOLIN, G Y GUIDASTRI, R. MANUAL ON HATCHERY PRODUCTION OF SEABASS AND GILTHEAD SEABREAM. Vol. II. FAO (1999).

RAM C. BHUJEL. STATISTICS FOR AQUACULTURE. Wiley-Blackwell 2009.

ROAR GUDDING (Editor), ATLE LILLEHAUG (Editor), OYSTEIN EVENSEN (Editor). FISH VACCINATION. Wiley-Blackwell 2014.

VOLLMANN-SCHIPPER, F. TRANSPORTE DE PECES VIVOS. ACRIBIA 1978

FACILITY DESIGN AND MANAGEMENT:

BEAZ PALEO, JOSÉ DANIEL. INGENIERÍA DE LA ACUICULTURA MARINA: CULTIVO DE MOLUSCOS Y CRUSTÁCEOS EN EL MAR. Fundación Observatorio Español de Acuicultura - CSIC, 2011

MALCOLM BEVERIDGE. CAGE AQUACULTURE. Wiley-Blackwell 2004.

M.B. TIMMONS/ J.M. EBELING/ AND R.H. PIEDRAHITA. ACUICULTURA EN SISTEMAS DE RECIRCULACION (Spanish Edition). Cayuga Aqua Ventures, LLC, 2009.

ODD-IVAR LEKANG . AQUACULTURE ENGINEERING, 2nd Edition. Wiley-Blackwell 2013.

NUTRITION AND FEEDING

FUNDACION ACUICULTURA. LA NUTRICIÓN Y ALIMENTACIÓN EN PISCICULTURA. MUNDI-PRENSA LIBROS, S.A. 2012



GUILLAUME, J. Y OTROS. NUTRICIÓN Y ALIMENTACIÓN DE PECES Y CRUSTÁCEOS.
MUNDI-PRENSA LIBROS, S.A. 2003

GENETICS AND BIOTECHNOLOGY

FUNDACION ACUICULTURA. GENÉTICA Y GENÓMICA EN ACUICULTURA. TOMO I:
GENÉTICA. MUNDI-PRENSA LIBROS, S.A 2012

FUNDACION ACUICULTURA. GENÉTICA Y GENÓMICA EN ACUICULTURA. TOMO II:
GENÓMICA. MUNDI-PRENSA LIBROS, S.A. 2012

REPRODUCTION

CARRILLO ESTEVEZ, MANUEL ADRIAN. LA REPRODUCCIÓN EN PECES: ASPECTOS
BÁSICOS Y SUS APLICACIONES EN PISCICULTURA. MUNDI-PRENSA LIBROS, S.A. 2012