Information about the subject

Degree: Bachelor of Degree in Marine Sciences

Faculty: Faculty of Veterinary Medicine and Experimental Sciences

Code: 270226 **Name:** Bioindicators

Credits: 6,00 **ECTS Year:** 0, 2, 3, 4 **Semester:** 1

Module: Optional Itinerary: Marine Biology, Optional Itinerary: Marine Biotechnology

Subject Matter: Bioindicators **Type:** Elective

Department: Oceanography and Environment

Type of learning: Classroom-based learning

Languages in which it is taught: Spanish

Lecturer/-s:

OPM3   Maria Garcia Sanz **(Responsible Lecturer)**   m.garcia@ucv.es

       Alejandro Jesus Molera Arribas   aj.molera@ucv.es

Module organization

Optional Itinerary: Marine Biology

Subject Matter	ECTS	Subject	ECTS	Year/semester
R+D in Marine Sciences	6,00	R&D in Marine Sciences	6,00	0, 2, 3, 4/1
Biology of Cetaceans	6,00	Cetaceans Biology	6,00	0, 2, 3, 4/1
Ichthyology	6,00	Ichthyology	6,00	0/1
Aquariology	6,00	Aquariology	6,00	0/1
Bioindicators	6,00	Bioindicators	6,00	0, 2, 3, 4/1
Protected Areas and Recovery of Species	6,00	Protected Areas and Recovery of Species	6,00	2, 3, 4/1
Clinic and Health of Aquatic Animals	6,00	Clinical Treatment and Healthcare of Aquatic Animals	6,00	0, 3, 4/1

Optional Itinerary: Marine Biotechnology

Subject Matter	ECTS	Subject	ECTS	Year/semester
Marine Biotechnology	6,00	Marine Biotechnology	6,00	2, 3, 4/1
Instrumental Techniques	6,00	Instrumental techniques	6,00	This elective is not offered in the academic year 25/26
Sea Food Technology	6,00	Sea Food Technology	6,00	2, 3, 4/1

Genetic Engineering	6,00	Gene Techniques	6,00	This elective is not offered in the academic year 25/26
Food Technology	6,00	Food Technology II	6,00	4/1
Food Hygiene and Safety	6,00	Food Hygiene and Safety	6,00	This elective is not offered in the academic year 25/26

Recommended knowledge

No prerequisites.

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 distinguishes the BIOINDICATOR concept and its application in aquatic systems.

R2   The student uses the appropriate organism according to the type of environmental alteration.

R3   The student knows the appropriate sampling techniques depending on the type of indicator to be collected.

R4   The student is able to write a comprehensible and organized text on different ecological aspects and assess the quality of an ecosystem.

R5   The student is able to determine through the use of taxonomic keys marine species used as indicators.

R6   The student extracts qualitative information from the study of organisms.

R7   The student seeks bibliographic information from different sources and is able to analyze it with a critical and constructive spirit.

Universidad
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**Course
guide**

**Year 2025/2026
270226 - Bioindicators**

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	Students are able to apply knowledge to their work in a professional way and have the competences enabling them to state and defend views and opinions as well as perform problem-solving tasks in their field of study.	x			
CB3	Students are able to collect and interpret relevant data (generally in their field of study) and give opinions that involve reflection on relevant social, scientific or ethical issues.			x	
CB4	Command of a foreign language		x		
CB5	Students develop the necessary learning skills to undertake further studies with a high level of autonomy.			x	

GENERAL		Weighting			
		1	2	3	4
CG1	Capacity to analyze and synthesize			x	
CG2	Capacity to organize and plan		x		
CG3	Mastering Spanish oral and written communication			x	
CG5	Knowing and applying Basic ITC skills related to marine science			x	
CG6	Capacity to manage information (capacity to look for and analyze information coming from different types of sources)				x
CG7	Decision making			x	
CG8	Capacity to work in interdisciplinary and multidisciplinary team			x	

		1	2	3	4
CG10	Critical and self-critical capacity			x	
CG11	Capacity to learn			x	
CG12	Capacity to adapt to new situations		x		
CG16	Capacity to apply theoretical knowledge			x	
CG17	Research skills			x	
CG18	Sensibility to environmental issues.				x

SPECIFIC		Weighting			
		1	2	3	4
CE1	Knowing and understanding contents, principles and theories related to Oceanography	x			
CE2	Knowing basic sampling techniques of water column, organisms, sediment and sea-bottoms as well as basic techniques of dynamic and structural variable measurement		x		
CE6	Applying marine instrument techniques	x			
CE7	Collecting, assessing, processing and interpreting oceanographic data, following the most recent theories			x	
CE8	Identifying and analyzing new problems and proposing solution strategies		x		
CE9	Knowing how to carry out experiments and measurements both in the laboratory and during sample collection			x	
CE10	Knowing how to use planning, designing and implementing research tools while surveying and assessing results		x		
CE11	Knowing how to do fieldwork and laboratory experiments in a safe and responsible way, promoting teamwork				x
CE22	Practical experience of methods of marine environmental impact assessment			x	

Assessment system for the acquisition of competencies and grading system

Assessed learning outcomes	Granted percentage	Assessment method
R1, R2, R3, R4	45,00%	Written test with theoretical and practical questions
R4, R6, R7	25,00%	Delivery of guided assignments, whose objectives and contents will be proposed by the teacher
R2, R3, R5, R6	20,00%	Laboratory test
R1, R2, R4, R7	10,00%	Oral presentation

Observations

This course is not eligible for single evaluation. According to the general evaluation and qualification regulations, the preferred evaluation system will be by means of continuous evaluation. Specifically:
The evaluation items "Delivery of guided assignments, whose objectives and contents will be proposed by the professor" and "Oral Presentation" will be evaluated following a continuous evaluation system by means of deliveries in which the evolution of the work will be reviewed. Attendance at practical sessions is mandatory.
The use of artificial intelligence (AI)-based tools is subject to the discretion of the teacher, who may establish specific limits or conditions depending on the training or assessment activity.

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   Teacher presentation of contents, analysis of competences, explanation and in-class display of skills, abilities and knowledge.

M2   Group work sessions supervised by the professor. Case studies, diagnostic tests, problems, field work, computer room, visits, data search, libraries, on-line, Internet, etc. Meaningful construction of knowledge through interaction and student activity.

M3   Activities carried out in spaces with specialized equipment.

M4   Supervised monographic sessions with shared participation.

M5   Application of multidisciplinary knowledge.

M6   Personalized and small group attention. Period of instruction and/or guidance carried out by a tutor to review and discuss materials and topics presented in classes, seminars, readings, papers, etc.

M8   Set of oral and/or written tests used in initial, formative or additive assessment of the student.

M9   Group preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical , practical and/or small-group tutoring sessions. Work done on the university e-learning platform (www.plataforma.ucv.es)

M10   Student's study: Individual preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical, practical and/or small-group tutoring sessions. Work done on the university e-learning platform (www.plataforma.ucv.es).

Course guide

IN-CLASS LEARNING ACTIVITIES

	LEARNING OUTCOMES	HOURS	ECTS
ON-CAMPUS CLASS M1	R1, R2, R3, R4	30,00	1,20
PRACTICAL CLASSES M2	R2, R3, R4, R5, R6, R7	10,00	0,40
LABORATORY M3	R2, R3, R5, R6	10,00	0,40
SEMINAR M4	R1, R3, R6	3,00	0,12
GROUP PRESENTATION OF ASSIGNMENTS M5	R4, R6, R7	2,00	0,08
TUTORIAL M6	R1, R2, R3, R4, R5, R6, R7	3,00	0,12
ASSESSMENT M8	R1, R2, R3, R4, R5, R6, R7	2,00	0,08
TOTAL		**60,00**	**2,40**

LEARNING ACTIVITIES OF AUTONOMOUS WORK

	LEARNING OUTCOMES	HOURS	ECTS
GROUP WORK M9	R4, R6, R7	20,00	0,80
INDEPENDENT WORK M10	R1, R2, R3, R4, R6, R7	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
1. Introduction	Definition of indicator, environmental indicator and, biological indicator. Potentiality of biological indicators. Concept of bioindicator. Characteristics of bioindicators. Concept of biomarker. Characteristics of biomarkers. Advantages and disadvantages of the use of biological indicators. Selection of biological indicators. Concept of biotic indice. Types of biotic indices. Strengths and weaknesses of biotic indices.
2. Aquatic organisms as indicators of environmental changes	Bioindicator species of different parameters：light, disolved oxygen, hydrodynamism, substrate nature, salinity, temperature, environmental stress, environmental health, contaminants agents. Biomarkers.
3. The Water Framework Directive and Marine Strategy Framework Directive	Objectives of DMA. Biological Indicators. Ecological status. Reference conditions. Environmental Quality Ratio (EQR). Representation and classification of ecological status.The Marine Strategies as tool for management of marine environment
4. Biological indicators based in macroalgae	Effect of nutrients on the algal community. Marine algae as indicators of environmental quality. Biotic indexes based on macroalgae. Rhodophyta Ratio/Phaeophyta. Index of Cheney. CARLIT Index. Macroalgal bioassays to evaluate the spatial extent of fish farm effluents. PR1: Application of the CARLIT Index
5. Biological indicators based in seagrasses	Bases for the design of indicators. Biotic indexes based on seagrasses. Multivariate indexes: POMI. CYMOX. Zostera marina as indicator of health ecosystem. PR2: Study of indicator variables in marine angiosperms.

6. Biological indicators based in phytoplanktonic organisms	Effect of nutrients on the phytoplankton community. Phytoplanktonic Indicators. PHYMED index. Control and monitoring of HABs. PR3: Calculation of indices based on phytoplankton communities.
8. Biological indicators based marine vertebrates	Sharks as bioindicators of pollution and trophic changes in marine ecosystems. The behavior of fish as biomarkers for the presence of environmental stressors. Species " flag " as environmental bioindicators: sea turtles. Seabirds as sentinels of ocean healt . Cetaceans as bioindicators of the health of the oceans.

Organization of the practical activities:

	Content	Place	Hours
PR1.	Practical work in Prat de Cabanes-Torreblanca. CARLIT index application.	Marine station	4,00
PR2.	Laboratory. Study of indicator variables in seagrasses	Laboratory	8,00
PR3.	Laboratory. Biotic index calculation based on phytoplankton communities	Laboratory	2,00
PR4.	Informatic. Biotic index calculation based on benthic macrofauna	Computer	4,00
PR5.	Laboratory. Biotic index calculation based on marine vertebrates	Laboratory	6,00

Course guide

Temporary organization of learning:

Block of content	Number of sessions	Hours
1. Introduction	3,00	6,00
2. Aquatic organisms as indicators of environmental changes	4,00	8,00
3. The Water Framework Directive and Marine Strategy Framework Directive	4,00	8,00
4. Biological indicators based in macroalgae	6,00	12,00
5. Biological indicators based in seagrasses	3,00	6,00
6. Biological indicators based in phytoplanktonic organisms	3,00	6,00
8. Biological indicators based marine vertebrates	7,00	14,00

References

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