



IDENTIFYING DATA

Marine Ecology

Subject	Marine Ecology			
Code	V10G061V01206			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Fernández Suárez, Emilio Manuel			
Lecturers	Fernández Suárez, Emilio Manuel Lasa Gonzalez, Aide Olabarria Uzquiano, Celia			
E-mail	esuarez@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	<p>Marine ecology is the first subject entirely focussed on Ecology in the Marine Science studies at the University of Vigo. The subject describes the main metabolic pathways in the biosphere, analyze how energy flows drive cycles of matter, introduces models of population dynamics and the interactions between populations and finally assesses the factors controlling the structure and functioning of marine ecosystems. The effect of anthropogenic perturbations on the functioning of marine ecosystems is introduced horizontally in the different units.</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
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C10	Know the biological diversity and functioning of marine ecosystems.
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.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.
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
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Capacity to understand and analyse the basic processes of the interactions between organisms.	A2 A3 A4 A5	B1	C10 C11	D1
Capacity to understand the bases of diversity and the the factors controlling organization and structure of the ecosystems	A2 A3 A4 A5	B1	C10 C11	D1 D5
To design, analyze, interpret and present experimental results	A2 A3 A4 A5	B1 B2 B4	C10 C11	D1 D2
To use software typically used in Marine Ecology	A2 A3 A4 A5	B2 B4	C11	D1 D2
To use the basic bibliography related to the ecological concepts	A2 A3 A4 A5	B1 B2	C10 C11	D1

Contents

Topic	
Ecology and environmental crisis	Construction of the sociocultural human niche. The anthropocene. Planetary boundaries. Ecology in an anthropogenic biosphere. Presentation of the subject.
Biogeochemical reactions in the sea	Energy in the ecosystem. Cycles of matter and energy flows. Metabolic diversity of the biosphere. Compartments, mass balances and residence time. Oxygen: distribution and redox gradients. Reactions of the carbon cycle: acidification. Reactions of the nitrogen cycle: eutrophication. Reactions of the phosphorus cycle: dynamics in the water-sediment interphase.
Energy flows and biological production	Primary production. Magnitudes. Control of primary production: efficiency of the photosynthesis, irradiance and nutrients. Hydrodynamic control of primary production: Sverdrup model. spatial and temporal variability of primary production. Secondary production. Efficiencies. Organic matter decomposition and remineralization. Microbial heterotrophic production.
Dynamics of isolated populations	Concept of individual and population. Characteristics of populations. Evolutionary strategies. Fundamental equation of population growth. density independent growth: exponential model. Density independent growth in aged-structured populations: life tables, survival curves, Allen diagrams. Density dependent growth: logistical model. Variations of the logistical model: Time-lag, Allee effect, discrete growth. growth.
Interactions between species	Interspecific competition. Experimental evidences of competition. Competition and ecological niche. Lots and Volterra model of competition. Predation. Functional and numerical responses. Variations of the Lotka and Volterra predation model.
Community structure and function	Concept, assembling and filters. Specific diversity, biodiversity, specific wealth and functional diversity. Equitativity: Abundance distribution models. Diversity indexes. Relation diversity-ecosystem function Diversity in space: spectrums and gradients. Food web topology. Key species and trophic cascades. Top-down vs bottom-up control.
Ecological succession and stability	Temporal changes in the community: succession and fluctuation. Explanatory models of succession. Succession and diversity. Effect of physical perturbations: Intermediate perturbation hypothesis. Succession and energy flow. Diversity-stability hypothesis. Meanings of stability. Concept of resilience: principles for sustaining ecosystem services.
Ecosystem conservation and management	Socio-ecological systems. Ecosystem services: offer and demand. Analysis of interactions and identification of conflicts. Bases of conservation ecology. Resilience-based ecosystem management. Non linear responses and histeresis. Principles for the maintenance of the ecosystem services.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	30	60	90

Seminars	7	14	21
Laboratory practical	8	24	32
Problem and/or exercise solving	1	0	1
Project	3	0	3
Essay questions exam	2	0	2
Objective questions exam	1	0	1

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

Methodologies	
	Description
Lecturing	Plenary lectures will be the main methodology used in the theoretical part of this subject.
Seminars	<p>Seminars will aim at a more personalized approach for the students to acquire complex concepts and tools in order to provide data analysis capacities that will be used in the experimental work</p> <p>The contents of these seminars will be:</p> <p>Seminar 1: experimental Design. Presentation of the experimental work. Seminar 2: Data Analysis I: ANOVA in Ecology. Practical case. Seminar 3: Data Analysis II. ANOVA. Anova in Ecology. Practical case. Seminar 4: Analysis of data of the experimental work. Presentation of scientific results.</p> <p>In the seminars 2, 3 and 4 will be necessary the utilisation of the statistical programs *R and *RStudio.</p>
Laboratory practical	<p>The experimental work consists in the design, sampling, experimentation, sample processing, data analysis, preparation and discussion of results and, finally, presentation of these results by the students. They will, therefore, develop all the phases of an investigation.</p> <p>The experimental work will be carried out in groups of 5 people advised by teachers. The results will be presented as a poster. The laboratory phase of the experimental work will proceed from 1st to 31st March and will last approximately one week.</p> <p>Seminars will tackle the necessary practical contents for the preparation of the work.</p> <p>The adequate organisation and development of the experimental work, requires to strictly respect the following recommendations:</p> <ol style="list-style-type: none"> 1. Members of each group should belong to the same group of seminars. 2. Laboratory work should be by all members of the group. 3. All members of the group should be involved in the advisory sessions devoted to the design of the experiment as well as to the analysis and interpretation of results.

Personalized assistance	
Methodologies	Description
Laboratory practical	All planned methodologies in this matter contemplates a personalised attention through voluntary tutorials. The schedule of personalized tutorials is the following: Monday, Wednesday and Thursday from 9 to 11 h. 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.
Seminars	All planned methodologies in this matter contemplates a personalised attention through voluntary tutorials. The schedule of personalized tutorials is the following: Monday, Wednesday and Thursday from 9 to 11 h. 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.
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Tests	Description

Problem and/or exercise solving	In all the planned methodologies in this matter contemplates a personalised attention. In the case of the sessions magistrales, these will develop through tutorías voluntary. The schedule of tutorías planned is the following: Monday, Wednesday and Thursday of 9 to 11 h. The students that wish it will be able to attend to *tutorías personalised to resolve doubts, mainly in the schedules that indicate . To optimise the time, is necessary that the students contact with the professor with antelación sufficient since this schedule can vary on time when the professor have other educational obligations, researchers or of management that attend.
Project	In all the planned methodologies in this matter contemplates a personalised attention. In the case of the sessions magistrales, these will develop through tutorías voluntary. The schedule of tutorías planned is the following: Monday, Wednesday and Thursday of 9 to 11 h. The students that wish it will be able to attend to tutorías personalised to resolve doubts, mainly in the schedules that indicate . To optimise the time, is necessary that the students contact with the professor with antelación sufficient since this schedule can vary on time when the professor have other educational obligations, researchers or of management that attend.
Essay questions exam	In all the planned methodologies in this matter contemplates a personalised attention. In the case of the sessions magistrales, these will develop through tutorías voluntary. The schedule of tutorías planned is the following: Monday, Wednesday and Thursday of 9 to 11 h. The students that wish it will be able to attend to tutorías personalised to resolve doubts, mainly in the schedules that indicate. To optimise the time, is necessary that the students contact with the professor with antelación sufficient since this schedule can vary on time when the professor have other educational obligations, researchers or of management that attend.
Objective questions exam	In all the planned methodologies in this matter contemplates a personalised attention. In the case of the sessions magistrales, these will develop through tutorías voluntary. The schedule of tutorías planned is the following: Monday, Wednesday and Thursday of 9 to 11 h. The students that wish it will be able to attend to tutorías personalised to resolve doubts, mainly in the schedules that indicate . To optimise the time, is necessary that the students contact with the professor with antelación sufficient since this schedule can vary on time when the professor have other educational obligations, researchers or of management that attend.

Assessment

	Description	Qualification	Training and Learning Results		
Problem and/or exercise solving	<p>The qualification of the seminars will be carried out by means of an examination in which the students will resolve practical cases and questions related with the contents of this section of the subject. The examination of seminars will consist in the resolution of problems using *R and *Rstudio. Besides, a proof will be conducted during the development of the seminars in which it will have to answer to questions on diverse aspects treated in the seminars. The proof will be announced at least 10 ahead.</p> <p>The assistance to the seminars is compulsory. The relative contribution of both proofs to the final qualification will be of 15% (10% the examination of seminars and 5% the proof).</p> <p>To approve the subject will be necessary to reach an upper qualification to 5, considering the whole of the activities *evaluables. Incidentally, it will have to obtain an equal or upper qualification to 4 points on 10 in the conjoint qualification *ponderada of the section of seminars and experimental work.</p>	15	A2 A3 A4 A5	B4 D1 D2	

Project	The qualification of the experimental work will be based on the quality of the content and the experimental design, on the treatment and presentation of the results and on the level of knowledge reached. A guide with the evaluation criteria will be provided.	30	A2 B1 C10 D1 A3 B2 C11 D2 A4 B4 A5
	The evaluation will consist of two sections. First, each group will elaborate a poster. Each group will defend the poster in oral format. Second, in this same session each student will make a short proof on the contents of the poster he/she elaborated.		
	The realisation of the experimental work, including the preparation and presentation of the poster, is compulsory. The relative weight of this part will be of 30% of the total qualification of the subject. The assessment of the poster will represent 60% of the qualification of the experimental work, whereas the proof written will represent 40%.		
	Those students who did not obtain the minimum qualification to pass this section of the subject and wish to try a second opportunity should deliver a new version of the poster, that will be again evaluated. Since all the students have had to present the poster during the first opportunity, it will not be needed to present it again in the second opportunity. The date of delivery of this new version of the poster will be previous to the date of the exam and the date will be announced in advance. The students will additionally answer a series of questions on the content of the poster during the final examination. Only students who presented a new version of the poster within the term established could answer to these questions.		
	To pass the subject it will be needed to reach a qualification of at least 5, considering the whole of the activities. Additionally, students should obtain qualification equal or higher than 4 points in the joint qualification of the section of seminars and experimental work.		
Essay questions exam	At the end of the course students will make a final examination that will represent the 40 % of the total qualification. To pass the subject it will be needed to reach a qualification of at least 5, considering the whole of the activities. Additionally, students should obtain a qualification equal or higher than 4 points in the qualification of the theoretical contents (joint weighted qualification of the final examination and the shot proofs.	40	A2 C10 D1 A3 C11 D2 A4 D5 A5
Objective questions exam	During the course, 3 proofs will be conducted on the concepts treated in the subject. These proofs will represent 15% of the final qualification. These short proofs will be done during the class. The date of realisation will be announced at least 10 days ahead.	15	A2 C10 D1 A3 C11 D2 A4 D5 A5

Other comments on the Evaluation

Global assessment option

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. Given the experimental nature of the practices and seminars, attendance to these two activities is mandatory to be eligible for this evaluation option. **Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).**

Second opportunity

The evaluation in the second opportunity will include an exam of theoretical contents and an exam of the contents of the seminars. Those students who did not obtain the minimum qualification to pass this section of the subject and wish to try a second opportunity should deliver a new version of the poster, that will be again evaluated. Since all the students have had to present the poster during the first opportunity, it will not be needed to present it again in the second opportunity. The date of delivery of this new version of the poster will be previous to the date of the exam and the date will be announced in advance. The students will additionally answer a series of questions on the content of the poster during the final examination. Only students who presented a new version of the poster within the term established could answer to these questions.

Students coursing this matter are requested to demonstrate a responsible and honest behaviour. It is considered as inadmissible any form of fraud (copy or plagiarism). Fraudulent behaviors are not acceptable and will imply a negative qualification of this subject. Dates, hours and place where the evaluation proofs will be conducted will be published in the official web of the Faculty of Sciences of the Sea.

Sources of information

Basic Bibliography

Rodríguez, J, **Ecología**, Pirámide, 2016

Begon, M, **Ecology**, Blackwell, 2006

Krebs, C.J, **Ecology**, 6ª, International Rev. Collins, 2013

Complementary Bibliography**Recommendations****Subjects that continue the syllabus**

Biological oceanography I/V10G061V01301

Biological oceanography II/V10G061V01306