



(\*)Facultade de Ciencias do Mar

(\*)Grao en Ciencias do Mar

## Subjects

### Year 4th

Code	Name	Quadmester	Total Cr.
V10G060V01701	Contaminación mariña	1st	6
V10G060V01702	Dinámica oceánica	1st	6
V10G060V01703	Pesqueiras	1st	6
V10G060V01704	Xestión mariña e litoral	1st	6
V10G060V01801	Acuicultura	2nd	6
V10G060V01909	Xeoloxía mariña aplicada	1st	6
V10G060V01991	Traballo de Fin de Grao	2nd	12

**IDENTIFYING DATA****Marine contamination**

Subject	Marine contamination			
Code	V10G060V01701			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	#EnglishFriendly Galician English			
Department				
Coordinator	Beiras García-Sabell, Ricardo			
Lecturers	Beiras García-Sabell, Ricardo Montalvo Rodríguez, Javier Viana González, Inés			
E-mail	rbeiras@uvigo.es			
Web	<a href="http://www.ecotox.es">http://www.ecotox.es</a>			
General description	Main pollutants, sources, environmental distribution, toxic effects. Marine environmental legislation.			

**Competencies**

Code	
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
CB2	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
CB3	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
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
CE4	To know the basic techniques to sample the water column, organisms, sediments and sea bottom, as well as the surveying methods for dynamic and structural variables
CE8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources
CE9	To be familiar with the public and private, national and international organizations and institutions related to the Marine Sciences
CE14	To recognize and analyze new problems and to propose problem-solving strategies
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries
CE22	To control marine pollution problems
CE26	To plan, direct and write technical reports on marine issues
CE30	Identify and assess environmental impacts in the marine environment
CE31	Ability to function and operate in public and private, national and international institutions in the field of marine science
CE32	Quality control of seafood
CE35	Water quality control in water treatment plants
CE37	Technical advice or assistance on issues related to the marine and coastal environment
CT1	Analysis and synthesis ability
CT9	Critical-review and self-criticism capacity
CT11	Ability to learn independently and continuously
CT15	Ability to apply knowledge in practice
CT16	Research skills
CT17	Sensitivity towards environmental issues

**Learning outcomes**

Learning outcomes	Competences
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2. Learn to distinguish the different types of pollution that can affect a coastal ecosystem and the distinct environmental parameters that result affected by each type.	CB1 CB2 CB3 CB4 CB5	CG1 CG2 CG4 CG6 CG10 CG17	CE4 CE8 CE9 CE13 CE14 CE16 CE19 CE22 CE24 CE26 CE27 CE30 CE31 CE31 CE32 CE35 CE37	CT1 CT1 CT2 CT3 CT9 CT11 CT15 CT16 CT17
3. Know the effects of the pollution to the distinct levels of organisation, since molecular to ecosystem, from an integrated and practical perspective, aiming at the use of those effects as indicators of pollution.		CG1 CG2 CG4 CG6 CG10 CG17	CE13 CE16 CE19 CE24 CE27 CE31	CT1 CT2 CT3
4. Know how to design an integrated study of evaluation of pollution in a coastal ecosystem, including the variables to measure and the samples to collect.		CG1 CG2 CG3 CG4 CG5	CE8 CE14 CE14 CE19 CE20	CT1 CT2 CT3 CT4 CT5 CT7 CT11
5. To get familiar with the study and the management of the waste water effluents in regard to the uses of the surface water bodies, with particular attention to estuaries and marine waters.		CG1 CG5 CG6 CG14	CE7 CE12 CE16	
6. To get familiar with the instruments of management and control of the human actions with impact on the coastline, and basic notions of the legislation involved in pollution control, within the autonomic, state and international administrations	CB1 CB2	CG1 CG2 CG3 CG4	CE8 CE8 CE10 CE12 CE22	CT1 CT5 CT8 CT14 CT18

## Contents

Topic	
Basic concepts	1. Introduction. Pollution, anthropogenic process. Pollution: deleterious effects. Environmental Quality Criteria and Standards. PBT substances. Sources, distribution and fate of pollutants in the marine compartments.
Urban and agriculture pollutants	2. Organic pollution. Sources: liquid wastes. Estimating the organic load in wastewaters and receiving waters: BOD, COD, TOC. Excess of organic matter: hypoxia and anoxia. 3. Pollution by excess of inorganic nutrients. Nitrogen and phosphorus in the marine environment; anthropogenic sources. Eutrophication and hypereutrophication. Detergents. 4. Microbial pollution. Pathogenic microorganisms present in marine waters. Microbiological analysis of water and shellfish. Self-depuration of natural waters. Disinfection of wastewaters.
Industrial pollutants	5. Hydrocarbons. Oil. Polycyclic Aromatic Hydrocarbons. Sources and weathering of oil in the sea. Effects on marine organisms. Oil spills, lessons learnt. 6. Organohalogenated pollutants. Organochlorine pesticides: sources and levels in the marine compartments; bioaccumulation and biomagnification. Toxicity. Polychlorinated biphenyls (PCBs). Polybrominated compounds (PBDEs); sources and levels in the marine compartments; toxicity. Dioxins and dibenzofurans. 7. Trace metals I. Background levels and enrichment factors. Distribution in the oceans. Mercury: Sources, distribution, bioaccumulation and biomagnification. Toxicity. Methylmercury. 8. Trace metals II. Copper, lead, cadmium. Sources, concentrations in marine compartments, toxicity. Trobutyltin (TBT).

- 9. Distribution of pollutants in the environment. Fugacity models. Environmental persistence and half-life. Biodegradation. Chemical speciation and bioavailability of metals.
  - 10. Bioaccumulation. Toxicokinetics. Uptake, accumulation and biotransformation of pollutants in the organisms. Bioconcentration factor (BCF). First order kinetic bioaccumulation models. Thermodynamic bioaccumulation models, Kow.
  - 11. Molecular and cellular responses to pollutants: biomarkers. Biotransformation and elimination of toxic chemicals. Lysosomal alterations. Metallothioneins and stress proteins. Cytochrome P450. Enzymatic alterations.
  - 12. Lethal and sublethal toxicity. Basic principles of toxicology. Dose:response curves. LC50/EC50 and toxicity threshold. Time and other factors affecting toxicity. Effects on reproduction and development. Effects on the bioenergetics and growth.
  - 13. Effects of pollution at population and community levels. Changes in the presence and abundance of populations. Bioindicators by presence and absence. Biological indices in communities.
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- Managing and assessing marine environmental quality
- 14. Integrative assessment of marine pollution. Coastal pollution monitoring programs. Integration of chemical and biological methods. Use of wild organisms as bioindicators and laboratory bioassays. The mussel watch approach
  - 15. Ecotoxicological bioassays. requirements and methodological aspects. Liquid phase: copepod survival, Seurchin Embryo Test (SET). Solid phase: amphipod survival, bivalve burrowing. In situ bioassays.
  - 16. Protection of the marine environment. I. Control at the point source discharges. Identification of priority pollutants. Evaluation of the ecological risk. Regulation of new chemical products. REACH. Regulation of complex effluents.
  - 17. Protection of the marine environment. II. Control of the levels of pollutants in receiving waters. Sediment and Water Quality Criteria and standards. International legislation. Water Framework Directive. Marine Strategy Framework Directive.

<b>Planning</b>			
	Class hours	Hours outside the classroom	Total hours
Lecturing	20	40	60
Seminars	12	28	40
Studies excursion	5	0	5
Laboratory practical	15	30	45

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

<b>Methodologies</b>	
	Description
Lecturing	The theoretical contents that will be evaluated in a final exam will be presented
Seminars	The basic scheme of the seminars consists in the following: 1. preparation by the student of a questionnaire and a practical case available through TEMA. 2. handing over the questionnaire to the teacher at the beginning of the seminar. 3. resolution and discussion of the case in common with the teacher.
Studies excursion	Field trip to a supposedly polluted zone with basic sampling material for sediments, water and biota. Collection of representative samples with support of the professor for further analysis in laboratory.
Laboratory practical	The practices consist in a field trip to an impacted site in the Port of Vigo, and the collection of environmental matrices (water *sub-superficial with oceanographic bottle, *sediment with *draga Vain *Veen dredge) and native mussels, with object to realize a series of observations, chemical analyses and biological essays in the laboratory, including the solids in suspension, phosphates, BOD5 and faecal microorganisms in water, organic matter, presence of indicator species and ecotoxicological bioassays with the sediments. After the days of laboratory the data obtained are shared in the TEMA platform, and individual memories must be elaborated and handed over to the teacher by the date of the final exam.

<b>Personalized assistance</b>	
Methodologies	Description
Lecturing	Power point presentations in the classroom; personal assistance in my office at tutorial times

Laboratory practical Practical work in the laboratory

Seminars Questionnaire elaboration and discussion

<b>Assessment</b>					
	Description	Qualification	Evaluated Competences		
Lecturing	multiple choice questions exam	70	CB1 CB2 CB3 CB4 CB5	CE8 CE9 CE14 CE16 CE22 CE31 CE32 CE35 CE37	CT1 CT9 CT11 CT16 CT17
Seminars	Mandatory presence in the seminars. Delivery of the corresponding individual questionnaires	15		CE22	
Laboratory practical	Mandatory presence in the practices and an individual report	15	CB1 CB2 CB3 CB4 CB5	CE4 CE26 CE31	CT15

### Other comments on the Evaluation

Date, time and place of exams will be published in the official web of Marine Sciences Faculty:

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

Students are strongly advised to fulfil an 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

Beiras, R., **Marine Pollution**, 1, Elsevier, 2018

Clark, R.B., **Marine Pollution**, 5<sup>a</sup> ed., Clarendon Press. Oxford, 2001

Walker C.H. et al., **Principles of ecotoxicology**, 4th ed., Taylor & Francis, 2012

E. Law, **Aquatic pollution**, 4a, Wiley, 2017

Beiras, R. e Pérez, S, **Manual de métodos básicos en contaminación acuática**, ECIMAT, 2013

#### Complementary Bibliography

Kennish, M.J., **Estuarine and marine pollution**, CRC Press, 1997

### Recommendations

#### Subjects that it is recommended to have taken before

Marine Ecology/V10G060V01401

**IDENTIFYING DATA****Ocean Dynamics**

Subject	Ocean Dynamics			
Code	V10G060V01702			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish English			
Department				
Coordinator	Souto Torres, Carlos Alberto			
Lecturers	Souto Torres, Carlos Alberto			
E-mail	ctorres@uvigo.es			
Web				
General description	Equations of the ocean and its solutions. The student will learn about the seven ocean equations and their main solutions, from the ocean waves scale to the planetary scale, like Rossby waves and Sverdrup and Stommel models.			

**Competencies**

Code	
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
CE2	To know and understand the essential facts, concepts, principles and theories related to oceanography
CE6	Ability to identify and understand the problems in the field of oceanography
CT1	Analysis and synthesis ability

**Learning outcomes**

Learning outcomes	Competences	
The ability to calculate solutions to those equations related with those dynamics.	CB4	CE2 CE6
Basic understanding of the role of the ocean in the global climate dynamics.		CE6 CT1

**Contents**

Topic	
Development of the ocean equations.	1.1 f plane approximation. 1.2 Beta plane approximation. Problems. 1.3 Continuity equation, deduction and interpretation. 1.4 Gauss theorem. 1.5 Momentum equation. Pressure forces. Viscous forces. Coriolis acceleration. Application and simplifications. 1.6 Energy conservation equation and salt conservation equation. 1.7 Equation of state. Approximations. 1.8 Recapitulation. 1.9 Problems.
Wavelike solutions of the equations	Wave kinematics. Dispersion relation.  2.1 Wavelike solutions I: Wave's dynamics. Short waves (deep water waves) and long waves (shallow water waves) approximations. Pressure and particles movement. Stokes drift. Problems. 2.2 Inertial movement and forced inertial movement. 2.3 Wavelike solutions II: Planetary waves. Kelvin waves. Rossby waves. Poincaré Waves.  2.4 Wavelike solutions III. Internal waves. Dynamics of internal waves with and without rotation. Stratified Internal waves.

Non wavelike solutions of the equations.

3.1 Geostrophic currents. Thermal wind equations. Sverdrup relation.  
3.2 Barotropic currents.  
Problems  
3.3 Ekman's surface and bottom layer and Ekman theory. Ekman's transport. Problems  
3.4 Barotropic wind forced oceanic circulation. Ekman's pumping. Vertically integrated equations. Sverdrup and Stommel model's. Vertical structure.  
Problems  
3.5 Baroclinic currents. Theory and applications. Problems.  
3.6 Stratification in the ocean. Static stability and friction. Problems.  
3.7 Eighth equation: Vorticity conservation. Applications.

## Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	36	58	94
Seminars	16	40	56

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

## Methodologies

	Description
Lecturing	Lectures developing the theory for 36 hours.
Seminars	Guided problem solving during 8 clases of 2 hours.

## Personalized assistance

### Methodologies Description

Lecturing	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	These sessions will be used to solve problems, previously available to the students, and to solve any doubt with the theory related.

## Assessment

	Description	Qualification	Evaluated Competences
Lecturing	Final test.	80	CB4 CE2 CE6
Seminars	Seminars test.	20	CE6

## Other comments on the Evaluation

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.

The tests' classroom, date and time will be published at the Marine Sciences' website:

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

## Sources of information

### Basic Bibliography

CUSHMAN-ROISIN, B., **Introduction to Geophysical Fluid Dynamics. Physical and Numerical Aspects**, Ray Henderson & Deirde Cavanaugh. U.S.A.,

POND, S., G.L.PICKARD, **Introductory Dynamical Oceanography**, Pergamon Press. Oxford,

### Complementary Bibliography

Periáñez, Raúl, **Fundamentos de oceanografía dinámica**, Secretariado de Publicaciones de la Universidad de Sevilla,

## Recommendations

### Subjects that continue the syllabus

Modelling/V10G060V01905

**Subjects that it is recommended to have taken before**

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Physical oceanography I/V10G060V01503

Physical oceanography II/V10G060V01602

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<b>IDENTIFYING DATA</b>				
<b>Fisheries</b>				
Subject	Fisheries			
Code	V10G060V01703			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish			
Department				
Coordinator	González Castro, Bernardino			
Lecturers	González Castro, Bernardino			
E-mail	bcastro@uvigo.es			
Web				
General description	This course aims to serve as an introduction to the dynamics of exploited populations and to the basic methodologies used in their assessment and management.			

<b>Competencies</b>	
Code	
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
CB2	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
CB3	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
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
CE4	To know the basic techniques to sample the water column, organisms, sediments and sea bottom, as well as the surveying methods for dynamic and structural variables
CE10	To know the problems and the basic principles of sustainability in relation to the use and exploitation of the marine environment
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory
CE29	Skill in the practical use of models and in the incorporation of new data for their validation, improvement and development
CE33	Fisheries control
CT1	Analysis and synthesis ability
CT6	Problem management and solving skills

<b>Learning outcomes</b>			
Learning outcomes	Competences		
Understand the population processes that affect the dynamics of living resources	CB3	CE10 CE33	CT1
Estimate parameters of interest for marine fisheries resources exploitation	CB2	CE15 CE29	CT6
Understand the basic methods of fisheries resource assessment	CB2	CE4 CE33	CT1
Understand and apply basic methods of fitting mathematical models for parameter estimation, population dynamics and assessment of marine living resources	CB1 CB2 CB5	CE15 CE29	CT6
Develop skills to use basic fisheries computer programs	CB2 CB5	CE29	CT6

<b>Contents</b>	
Topic	
Characterization of marine fisheries resources	Types of resources. Marine areas of interest in the exploitation of resources. Degree of exploitation of marine living resources.
The fishing process	Fishing gears, boats and methods. Selectivity of fishing gears
The unit stock	Population and stock. Population parameters. Characterization of management units. Estimation of abundance of exploited stocks

Reproduction	Maturation and fecundity. Estimation of maturity. Age and size of first maturity. Estimation of fecundity.
Recruitment	Estimation of recruitment. Stock-recruitment relationship. Population dynamics and stock-recruitment relationships.
Age and growth	Concept of cohort. Determination of age. Length-weight relationship. Allometry and isometry. Condition indices. Mathematical expressions of growth. Age-length keys.
Growth parameters	The von Bertalanffy growth model. Estimation of growth parameters: length-frequency analysis, separation of cohorts, size-at-age analysis, length increments analysis. Conversion of length to age.
Mortality	Survivorship curves. Mortality rates. Natural and fishing mortalities. Fishing effort. Capturability. Catch: Catch equations, Catch rates. Estimation of total, natural and fishing mortalities. Estimation of catchability.
Population dynamics and assessment models of fish stocks	Cohort Analysis: Virtual Population Analysis, Pope's Cohort Analysis. Biomass dynamic models. Yield and biomass per recruit models.
Fisheries Management	Biological reference points. Harvest strategies. Harvest tactics. International organizations and resource management.
Methodologies of parameter estimation	Estimation with Excel. Estimation with FISAT. Application of an age-structured model of harvested populations.

### Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32	48	80
Laboratory practical	4	2	6
Computer practices	12	6	18
Problem solving	4	4	8
Mentored work	0	34	34
Essay questions exam	3	0	3
Problem and/or exercise solving	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	Oral presentation of the contents of the subject using the blackboard and computer presentations.
Laboratory practical	Size selectivity of a dredge for shellfish resources.
Computer practices	Learning and application of numerical methodologies for resolution of parameters and resolution of quantitative problems related to the contents of the subject. Learning and use of basic programs used in the evaluation of marine living resources. Simulation of the dynamics of an exploited population and calculation of Reference Points for fisheries management.
Problem solving	Solution of numerical problems related to the methods explained in the lectures and practices.
Mentored work	Reading of a scientific publication related to the contents of the subject and answering several questions about it.

### Personalized assistance

Methodologies	Description
Lecturing	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Monday and Wednesday from 15:00 to 18:00 h. Outside of these hours according to availability of the teacher.
Laboratory practical	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Monday and Wednesday from 15:00 to 18:00 h. Outside of these hours according to availability of the teacher.
Computer practices	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Monday and Wednesday from 15:00 to 18:00 h. Outside of these hours according to availability of the teacher.

Mentored work	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Monday and Wednesday from 15:00 to 18:00 h. Outside of these hours according to availability of the teacher.
Problem solving	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Monday and Wednesday from 15:00 to 18:00 h. Outside of these hours according to availability of the teacher.

<b>Assessment</b>					
	Description	Qualification	Evaluated Competences		
Lecturing	Written examination on the contents of the master sessions	50	CB1 CB2 CB5	CE10 CE33	CT1
Laboratory practical	Written examination on the contents of the laboratory practices.	5	CB1 CB2	CE4 CE15	
Computer practices	Written examination on the contents of the computer room sessions.	10	CB2 CB5	CE15 CE29	
Problem solving	Written examination of numerical problems of the subject.	20	CB1 CB2 CB5		CT6
Mentored work	Reading of a scientific work on content related to the subject and answering in writing a question form about it.. This task is voluntary, if the student does not do it, his qualification will be based exclusively on the written exam.	15	CB2 CB3	CE33	CT1

#### **Other comments on the Evaluation**

The "Laboratory practices" and "Practices in computer rooms" are shown separately by requirement of this platform, but their evaluation and scoring is joint, not making a distinction between both. In other words, there will be a single evaluation of "Practices" whose Qualification represents 15% of the total qualification.

The tutored work is voluntary and must be delivered before December 13, 2019 at 13:00 h. The mark of the tutored work will be preserved for the second call. If the student does not do it, the qualification of the subject will be derived exclusively from the rest of the sections, in the following way "Master lesson" 58.3%, Practices ("Laboratory practices" + "Practices in computer classroom") 25% and " Problem solving "16.7%. The mark of the tutored work will be preserved for the second call.

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**

King, M., **Fisheries biology, assessment and management**, Blackwell Publishing, 2007

Sparre, P. y Venema, S. C., **Introducción a la evaluación de recursos pesqueros tropicales. Part 1**, FAO, 1997

Jennings, S.; Kaiser, M. J. and Reynolds, J. D., **Marine Fisheries Ecology**, Blackwell Science, 2001

##### **Complementary Bibliography**

Hilborn, R. and Hilborn, U., **Overfishing. What everyone needs to know**, Oxford University Press, 2012

#### **Recommendations**

##### **Subjects that it is recommended to have taken before**

Marine Ecology/V10G060V01401

Statistics/V10G060V01303

Fish and shellfish biology/V10G060V01902

##### **Other comments**

To carry out the exams the student must have a calculator able to perform linear regression.

**IDENTIFYING DATA****Marine and coastal management**

Subject	Marine and coastal management			
Code	V10G060V01704			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish			
Department				
Coordinator	Pérez Arlucea, Marta María			
Lecturers	Alejo Flores, Irene Méndez Martínez, Gonzalo Benito Pérez Arlucea, Marta María			
E-mail	marlucea@uvigo.es			
Web	<a href="http://www.researchgate.net/profile/Marta_Perez-Arlucea">http://www.researchgate.net/profile/Marta_Perez-Arlucea</a>			
General description	In this matter presents a multidisciplinary vision of the coastal and marine zone, identifying the conflicts and risks associated to these areas. They enter the main tools for the management of these two environments as well as the administrative context-legislative in that it is framed the coastal and marine management.			

**Competencies**

Code	
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field
CE3	Critical understanding of the history and current status of the Marine Sciences
CE6	Ability to identify and understand the problems in the field of oceanography
CE8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources
CE9	To be familiar with the public and private, national and international organizations and institutions related to the Marine Sciences
CE10	To know the problems and the basic principles of sustainability in relation to the use and exploitation of the marine environment
CE11	To manage the use of littoral and coastal region and their resources in a sustainable way
CE14	To recognize and analyze new problems and to propose problem-solving strategies
CE21	To manage marine and coastal protected areas
CE26	To plan, direct and write technical reports on marine issues
CE30	Identify and assess environmental impacts in the marine environment
CE37	Technical advice or assistance on issues related to the marine and coastal environment
CT1	Analysis and synthesis ability
CT2	Organization and planning skills
CT17	Sensitivity towards environmental issues

**Learning outcomes**

Learning outcomes	Competences	
Critical understanding of the history and current state of the management of the coastal and marine zones	CE3	CT1
Knowledge and critical assessment of the sources of information for coastal and sea planning and management	CE1	
Elaborate thematic maps	CE11	CT1
Capacity to understand the application of the corresponding sectorial legislations	CE6 CE8 CE9 CE10	CT2
To know and evaluate the legal uses of the coastal and marine areas	CE10 CE11 CE14	CT1 CT2
To understand the sustainable use of the resources	CE21 CE26	CT2 CT17
To evaluate the environmental impacts in the coastal and marine zones	CE30 CE37	CT17

**Contents**

Topic	
1. Processes and state of the coastal environments	1.1. Processes and state of the coastal environments

2. Management of the coastal space	2.1. Criteria of management 2.2. Experiences
3. Tools and Technics for the planning and management of the sea	3.1. Methodologies 3.2. Technics
4. Intervention instruments in the coast and marine areas	4.1. The Law of the Coast 4.2. Urbanistic Legislation applicable to the protection of the seaboard 4.3. Protection of natural areas, elements and species of interest 4.4. Use and conservation of the coastal spaces for turistic uses. 4.5. Management of port spaces 4.6. The management of the installations and spaces for the aquaculture
5. Evaluations of impact	5.1. Basic concepts 5.2. Evaluation of projects 5.3. Evaluation of plans and programs
6. Jurisdictional Waters and territorial sea	6.1. Basic concepts and international norms 6.2. Methodologies 6.3. The Spanish rule 6.4. Examples of application
7. Impact of the global change in the half marine and coastal	7.1. General problems 7.2. Models of prediction and mitigation measures.

### Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	23	46	69
Seminars	14	30	44
Studies excursion	8	11	19
Computer practices	7	9	16
Problem and/or exercise solving	2	0	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	Theoretical contents. Concepts, etc.
Seminars	7 Seminars on subjects related with the Theory: preparation of bibliographic works and exhibition
Studies excursion	Field trip to Lanzada Beach for the observation of natural environments and human modifications, impacts, etc.
Computer practices	P1-Legal territorial boundaries P2-Evaluation of environmental impact

### Personalized assistance

Methodologies	Description
Seminars	7 seminars of 2 hours in which the lecturer will enter a subject and the students will work on a questionnaire. All the questions will be solved in the seminars. There will be personal tutorials for the preparation of the oral and written presentations in previously scheduled sessions.
Lecturing	23 classes of 1 hour. Students will have access to tutorials, mainly in the indicated schedules. It is advisable that the student contact the lecturer by e-mail.
Computer practices	1 sessions of 4 hours, in the computer room. They will approach different subjects applied of coastal management, where the students will have to solve problems posed during the practice. The doubts and questions will be addressed during the practice.
Studies excursion	Field trip to Lanzada Beach. The students will have the opportunity to ask any scientific questions along the day to complete their field memory.

### Assessment

Description	Qualification	Evaluated Competences
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Lecturing	The evaluation will consist of a written exam.  To be approved, the student need to obtain a minimum of 4.5 points on the condition that the global average reaches 5 points.	45	CE3 CE6 CE8 CE9 CE10 CE11 CE14 CE21 CE26 CE30 CE37	CT1 CT2 CT17
Seminars	Assistance is compulsory.  To be approved, the student need to obtain a minimum of 4.5 points on the condition that the global average reaches 5 points.	30	CE3 CE6 CE8 CE14 CE30	CT1 CT2 CT17
Studies excursion	Delivery of a memory of field/questionnaire	5		
Computer practices	Assistance is compulsory.  To pass the proofs, the students will need to obtain a minimum of 4.5 points on the condition that the global average reaches 5 points.  The students will present the required tests, memoires, etc. the same day at the end of the practice.	20	CE6 CE8 CE10 CE11 CE14 CE21 CE26 CE30	CT1 CT17

### Other comments on the Evaluation

Date, time and place of exams will be published in the official web of Marine Sciences  
Faculty: <http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

The students are required a responsible and honest behaviour. Any form of fraud (i.e. copies and/or plagiarism) directed to alter the level of knowledge or skill reached by the student/to in any type of proof, report or work designed with this purpose is consider inadmissible. The fraudulent behaviours will suppose the suspension of the subject during a complete course. An internal file containing these irregular behaviors will be started, and subsequently the lecturer would be able to request the opening of a disciplinary file in the rectorship.

### Sources of information

#### Basic Bibliography

Barragán Muñoz, J.M., **Las áreas litorales de España. Del análisis geográfico a la gestión integrada**, Ed. Ariel,  
Doménech, J.L., Sardá, R., Carballo, A., Villasante, C.S., Barragán, J.M., Borja, A., Rodríguez, M.J, **Gestión integrada de zonas costeras**, AENOR ediciones,  
Masselink, G. y Gehrels, R., **Coastal environments and global change**, Wiley,  
Gómez Orea, D. y Gómez Vilarino, A., **Evaluación de impacto ambiental**, MP,

#### Complementary Bibliography

Barragán Muñoz, J.M., **Coastal management and public policy in Spain**, Ocean and Coastal Management,  
Comisión Europea, **Programa de demostración de la UE sobre la Gestión Integrada de las Zonas Costeras 1997-1999. Hacia una estrategia europea para la gestión integrada de las zonas costeras. Principios generales y opcio**, Luxemburgo, Oficina de Publicaciones Oficiales de las Comunidades Europeas,  
Prada, A., Vázquez-Rodríguez, M.X., Soliño-Millán, M., **Desarrollo sostenible en la costa gallega**, CIEF, Centro de Investigación Económica y Financiera, Fundación Novacaixagalicia,  
Barragán Muñoz, J.M., **Política, Gestión y Litoral: Una nueva visión de la Gestión Integrada de Áreas Litorales**, Tébar Flores,  
Barragán Muñoz, J.M., **Medio Ambiente y desarrollo en áreas litorales**, Servicio de publicaciones de la U. Cádiz. ,  
Gómez Orea, D., **Evaluación ambiental estratégica**, Mundiprensa,  
Prada, A., Vázquez-Rodríguez, M.X., Soliño-Millán, M, **Desarrollo sostenible en la costa gallega,**, CIEF, Centro de Investigación Económica y Financiera, Fundación Novacaixagalicia,

### Recommendations

#### Subjects that continue the syllabus

Final Year Dissertation/V10G060V01991

#### Subjects that are recommended to be taken simultaneously

Applied marine geology/V10G060V01909

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**Subjects that it is recommended to have taken before**

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Marine Ecology/V10G060V01401

Coastal and marine sedimentary habitats/V10G060V01402

Sedimentology/V10G060V01305

Economics and legislation/V10G060V01903

Geological oceanography I/V10G060V01504

Geological oceanography II/V10G060V01603

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<b>IDENTIFYING DATA</b>				
<b>Aquaculture</b>				
Subject	Aquaculture			
Code	V10G060V01801			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	2nd
Teaching language	Spanish			
Department				
Coordinator	Rocha Valdes, Francisco Javier			
Lecturers	Rocha Valdes, Francisco Javier			
E-mail	frocha@uvigo.es			
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.			

<b>Competencies</b>	
Code	
CB2	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
CB3	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
CE8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources
CE14	To recognize and analyze new problems and to propose problem-solving strategies
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries
CE23	To design, control and manage recovery centers for threatened marine species
CE30	Identify and assess environmental impacts in the marine environment
CE32	Quality control of seafood
CE34	To design, control and manage aquaculture production plants
CE36	aquariology
CT2	Organization and planning skills
CT15	Ability to apply knowledge in practice

<b>Learning outcomes</b>		<b>Competences</b>		
Knowing the potentially cultivable marine species in the world	CB3	CE34	CT15	CE36
Know the aquaculture installations in land and sea		CE23		CE30
		CE34		CE36
Dominate the aquaculture auxiliary techniques (phytoplankton and zooplankton) and the culture technics of the main species that are cultivate now in Europe	CB2	CE14	CT15	CE23
		CE34		CE36
Know the treatments for the water in the culture systems		CE30		CE34
		CE36		
Recognise and analyse problems and propose solution strategies	CB2	CE14	CT2	
	CB3		CT15	
Identify and control problems of environmental impact and marine pollution caused by marine aquaculture	CB2	CE14	CT2	CE30
		CE30	CT15	
Design, control and management of culture centres and recovery of marine endangered Species		CE16	CT2	CE23
		CE23	CT15	
Known the operational details of marine companies, recognise specific problems and propose solutions		CE8	CT2	CE14
		CE16		CE30
		CE30		CE34



**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.
GILTHHEAD 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.

<b>Planning</b>			
	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
Practices report	0	2	2

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

<b>Methodologies</b>	
	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"> <li>1. Visit the farmed salmon in Cotobade (Pontevedra).</li> <li>2. Site visit of the Galician Institute for Aquaculture Training of the Galician Government in the Island of Arousa.</li> </ol>

<b>Personalized assistance</b>	
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	Evaluated Competences
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 be required to approve.	10	CE30 CE34 CE36
Laboratory practical Laboratory practices are considered an essential part of the subject. Practices will be evaluated by the attendance and assistance of students to them.	5	CB2 CE14 CT2 CT15
Essay There will be a long written test on the official date will be assessed on the questions exam 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	CB2 CE14 CB3 CE23 CE30 CE34 CE36
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	CE30 CE36
Practices report 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	CE14 CT2 CE30

### 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 qualification 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 Ecology/V10G060V01401

Marine and coastal management/V10G060V01704

**Subjects that it is recommended to have taken before**

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Marine Ecology/V10G060V01401

Marine zoology/V10G060V01405

Fish and shellfish biology/V10G060V01902

Marine and coastal management/V10G060V01704

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**IDENTIFYING DATA****Applied marine geology**

Subject	Applied marine geology			
Code	V10G060V01909			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Méndez Martínez, Gonzalo Benito Gago Duport, Luís Carlos			
Lecturers	Díez Ferrer, José Bienvenido Francés Pedraz, Guillermo Gago Duport, Luís Carlos González Villanueva, Rita Méndez Martínez, Gonzalo Benito			
E-mail	duport@uvigo.es mendez@uvigo.es			
Web	<a href="http://http://webc10.webs.uvigo.es/ficha.php?id=16">http://http://webc10.webs.uvigo.es/ficha.php?id=16</a>			
General description	It is a theoretical-practical subject that is directed to the integration of previous acquired geological knowledge, focusing its application on the study of geological risks, marine geological resources and advice in coastal engineering.			

**Competencies**

Code	
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
CB2	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
CB3	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
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
CE6	Ability to identify and understand the problems in the field of oceanography
CE11	To manage the use of littoral and coastal region and their resources in a sustainable way
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use
CE14	To recognize and analyze new problems and to propose problem-solving strategies
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries
CE20	To find and evaluate marine resources of various kinds
CE26	To plan, direct and write technical reports on marine issues
CE30	Identify and assess environmental impacts in the marine environment
CE37	Technical advice or assistance on issues related to the marine and coastal environment
CT1	Analysis and synthesis ability
CT6	Problem management and solving skills

**Learning outcomes**

Learning outcomes	Competences		
1. Know and locate the main marine geological resources	CB1 CB2 CB3 CB5	CE6 CE20	CT1
2.- Know interpret and integrate geophysical and geological data in the exploration and prospection of marine geological resources	CB1	CE13 CE20	CT1 CT6
3. Know the main geological risks sea coasts and submarines and the consequences	CB3	CE6 CE14 CE16 CE30	CT1

4. Geochemical modelling of pollution processes in the marine environment.	CB2 CB3	CE11 CE13 CE16 CE30 CE37	CT1
5. Realisation of geological reports.	CB3	CE14 CE26 CE30 CE37	CT1

## Contents

Topic	
1-Introduction. (1 hour class).	1.0. Introduction.
2 - Coastal and submarine Geological Risks (GR). (6 hours class) (6 hours seminars) (8 hours field trip) (4 hours practical works)	Theory 2.1. Definition and types of coastal and submarine GR. 2.2. Coastal and submarine GR linked to the external geodynamics 2.3. Coastal and submarine GR linked to the internal geodynamics. 2.4. Changes in sea level.  Field trip: Risks of coastal flood. Data collection.  Practices: Geochemistry of marine pollution processes.  Seminars 1, 2 and 3: Submarines volcanic risks and tsunamis.
3- Marine Geological Resources (11 hours class) (6 hours seminars)	Theory 3.1. Distribution and origin of the elements present in the sea and in the marine sediments. 3.2. Methods and technical of exploration and exploitation of marine geological resources. 3.3. Marine mineral resources (MMR). 3.3.1. Sediments no consolidated: Arid, placers deposits and salts. 3.3.2. deposits in nodules and crusts: Phosphorites, nodules and crusts of Fe-Mn. 3.3.3. Hydrothermal deposits. 3.4. Marine energetic resources (MER) and Geology of the Carbon. 3.4.1. Exploration and exploitation of hydrocarbons 3.4.2. Origin and interest of the hydrates of gas as resource. 3.5. Mechanisms of capture and transformation of the CO2  Seminars 4, 5 and 6: Resolution of practical exercises in relation to the exploration of hydrocarbons.
4 □ Impact of human activity in the coast. Marine geology and Society (8 hours field trip) (2 hours seminars)	Field Trip: Different coastal examples in which detailed geological studies are needed  Seminar 7. Discussion on the treatment given to different past and present coastal geological problems.

## Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	54	72
Seminars	14	28	42
Laboratory practical	4	12	16
Studies excursion	16	0	16
Essay questions exam	2	0	2
Problem and/or exercise solving	1	0	1
Problem and/or exercise solving	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	Theoretical classes
Seminars	Exhibition of practical cases. Resolution of exercises related. Debate.
Laboratory practical	Seawater pollution geochemistry

Studies excursion Risks of coastal flood and data collection. Human activity in coasts, geological context analysis.

### Personalized assistance

Methodologies	Description
Lecturing	Theoretical classes. □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	Analysis of different topics related to the competences of the subject. Detailed instructions on how to report a file. Specialised Database query. Advise on the choice of a topic to develop in the report. Resolution of doubts through individualised tutoring. □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□
Laboratory practical	Explanation and preparation of geological risk maps in coastal zones in small groups. □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□
Studies excursion	Risk mapping. Data analysis of anthropic activity in the coast and its relationship with the geological environment. □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	Part of the theoretical-practical test
Problem and/or exercise solving	Part of the theoretical-practical test
Problem and/or exercise solving	Part of the theoretical-practical test

### Assessment

	Description	Qualification	Evaluated Competences		
Lecturing	Compulsory assistance	0			
Seminars	Assistance, participation and content of the deliverables with various issues and resolution of exercises related to the content of the seminar. One deliverable at the end of each block of seminars (3 in total). Fundamentally, in the debate are valued the scientific-technical datas that support the presented arguments.	40	CB1 CB2 CB3	CE6 CE30	CT1
Laboratory practical	Assistance, participation and delivery of the memory.	10	CB1 CB3	CE11 CE13	CT1 CT6
Studies excursion	Assistance, participation and delivery of the report.	10	CB3	CE11 CE13 CE14 CE20 CE30	CT1
Essay questions exam	Part of the theoretical-practical test.	30	CB1 CB5	CE11 CE20 CE30 CE37	
Problem and/or exercise solving	Part of the theoretical-practical test.	5	CB1	CE20 CE30	CT6
Problem and/or exercise solving	Part of the theoretical-practical test.	5	CB2	CE6 CE11	CT1 CT6

### Other comments on the Evaluation

The attendance to the theoretical classes, practices, seminars and field trips is obligatory. Students who do not attend seminars or practices may not submit the relevant reports and be presented to the overall assessment.

For a student to be considered "Not Presented" does not have to have been evaluated in any item.

The final exam, in any of the calls, will include any theoretical and/or practical aspects exposed during the course, including fieldtrips, practices and seminars.

### Ordinary call.

In order to pass the subject by **continuous evaluation** and to take the final written test that represents 40% of the mark, it will be necessary to exceed 40% of the mark in each and every evaluable items. Otherwise it is considered that the student goes to **global evaluation** and is presented to a single final written test for 100% of the score.

### Extraordinary call

A single exam that counts 100% of the score.

Exam dates and classes can be viewed on the website of the Faculty of Marine Sciences.

### Individualised tutoring

Tutoring schedules of teachers of the subject can be found on the TEMA platform.

□Students are strongly requested to fulfil an 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□

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## Sources of information

### Basic Bibliography

Beatley, T., **An Introduction to coastal zone management**, second edition, Island Press, 2002

Burns, R. (Ed.), **Marine Minerals. Reviews in Mineralogy, vol 6**, Mineralogical Society of America, 1979

Craig, J.R., Vaughan, D.J. & Skinner, B.J., **Recursos de la Tierra y el Medio Ambiente.**, 4ª Ed., Pearson Education, 2012

Cronan, D.S., (Ed.), **Marine Minerals in Exclusive Economic Zones**, Chapman & Hall, 1992

Earney, P.C.E., **Marine Mineral Resources**, Taylor & Francis, 2012

### Complementary Bibliography

Couper, A., **The Times Atlas and Encyclopaedia of The Sea**, Times Book Ltd., 1989

Cronan, D.S., **Handbook of Marine Mineral Deposits**, CRC Press, 1999

Keller, E.A., Blodgett, R.H., **Riesgos Naturales: Procesos de la Tierra como riesgos, desastres y catástrofes**, Pearson Educación, 2007

Méndez, G., Rey, D., Bernabeu, A.M., Manso, F. y Vilas, F., **Recursos minerales marinos en la costa gallega y plataforma adyacente**, Journal Iberian Geology, 26, 2000

Seibold, E.; Berger, W.H., **The sea floor. An introduction to marine geology**, third Edition, Springer, 2010

Teleki, P.G, Dobson, M.R., Moore, J.R. & von Stackelberg, U. (Eds.), **Marine Minerals. Advances in Research and Resource Assessment**, Springer, 1987

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## Recommendations

### Subjects that are recommended to be taken simultaneously

Marine contamination/V10G060V01701

Marine and coastal management/V10G060V01704

### Subjects that it is recommended to have taken before

Coastal and marine sedimentary habitats/V10G060V01402

Sedimentology/V10G060V01305

Geological oceanography I/V10G060V01504

Geological oceanography II/V10G060V01603



**IDENTIFYING DATA****Traballo de Fin de Grao**

Subject	Traballo de Fin de Grao			
Code	V10G060V01991			
Study programme	Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	12	Mandatory	4	2c
Teaching language	Castelán Galego Inglés			
Department	Xeociencias mariñas e ordenación do territorio			
Coordinator	Francés Pedraz, Guillermo			
Lecturers	Francés Pedraz, Guillermo			
E-mail	gfrances@uvigo.es			
Web	<a href="http://http://webs.uvigo.es/facultadeccdomar/index.php/es/trabajo-fin-de-grado">http://http://webs.uvigo.es/facultadeccdomar/index.php/es/trabajo-fin-de-grado</a>			
General description	O Traballo de Fin de Grao (TFG) é unha materia dentro do plan de estudos do título de Grao de Ciencias do Mar. É un traballo persoal que cada estudante realizará de forma autónoma baixo titorización docente e debe permitirlle mostrar de forma integrada a adquisición de contidos formativos e as competencias asociadas ao título de Ciencias do Mar.			

**Competencias**

Code	
CB1	Que os estudantes demostren posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral e adoita atoparse a un nivel que, malia se apoiar en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo.
CB2	Que os estudantes saiban aplicar os seus coñecementos ó seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo.
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética.
CB4	Que os estudantes poidan transmitir información, ideas, problemas e solución a un público tanto especializado coma non especializado.
CB5	Que os estudantes desenvolvan aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía.
CE1	Coñecer vocabulario, códigos e conceptos inherentes ao ámbito científico oceanográfico
CE2	Coñecer e comprender os feitos esenciais, conceptos, principios e teorías relacionadas coa oceanografía
CE3	Comprensión crítica da historia e do estado actual das Ciencias do Mar
CE4	Coñecer as técnicas básicas de mostraxe na columna de auga, organismos, sedimentos e fondos, así como de medida de variables dinámicas e estruturais
CE5	Coñecemento básico da metodoloxía de investigación en oceanografía
CE6	Capacidade para identificar e entender os problemas relacionados coa oceanografía
CE7	Coñecer as técnicas básicas da economía de mercado aplicada aos recursos mariños
CE8	Comprender os principios das leis que regulan a utilización do medio mariño e os seus recursos
CE9	Coñecer as Institucións e Organismos públicos e privados, nacionais e internacionais relacionados coas Ciencias do Mar
CE10	Coñecer a problemática e os principios básicos da sustentabilidade en relación coa utilización e explotación do medio mariño
CE11	Planificar usos do litoral e do medio mariño e xestión sustentable dos recursos
CE12	Manexar técnicas instrumentais aplicadas ao mar
CE13	Tomar datos oceanográficos, avalialos, procesalos e interpretalos con relación ás teorías en uso
CE14	Recoñecer e analizar novos problemas e propoñer estratexias de solución
CE15	Recoñecer e implementar boas prácticas científicas de medida e experimentación, tanto en campaña como en laboratorio
CE16	Planificar, deseñar e executar investigacións aplicadas desde a etapa de recoñecemento ata a avaliación de resultados e descubrimentos
CE17	Saber traballar en campañas e en laboratorio de xeito responsable e seguro, fomentando as tarefas en equipo
CE18	Transmitir información de forma escrita, verbal e gráfica para audiencias de diversos tipos
CE19	Caracterizar, clarificar e cartografar fondos mariños, subsolos mariños e áreas litorais
CE20	Buscar e avaliar recursos de orixe mariña, de diversas clases
CE21	Xerir áreas mariñas e litorais protexidas
CE22	Controlar problemas de contaminación mariña
CE23	Deseñar, controlar e xerir centros de recuperación de especies mariñas ameazadas

CE24 Participar e realizar programas de formación e divulgación sobre os medios mariño e litoral
CE25 Participar e asesorar en investigacións sobre clima mariño
CE26 Planificar, dirixir e redactar informes técnicos sobre cuestións mariñas
CE27 Comprender os detalles do funcionamento de empresas vinculadas ao medio mariño, recoñecer problemas específicos e propoñer solucións
CE28 Impartir docencia no ámbito científico nos diferentes niveis educativos
CE29 Destreza no uso práctico de modelos, incorporando novos datos para a validación, mellora e evolución dos mesmos
CE30 Identificar e avaliar impactos ambientais no medio mariño
CE31 Capacidade para desenvolverse e entenderse nas institucións públicas e privadas, nacionais e internacionais do ámbito das Ciencias do mar
CE32 Control de calidade de alimentos mariños
CE33 Control de pesqueiras
CE34 Deseñar, controlar e xerir plantas de produción acuícola
CE35 Control de calidade de augas en plantas depuradoras
CE36 Acuarioloxía
CE37 Asesoría ou asistencia técnica en temas relacionados co tema mariño e litoral
CE38 Usos técnicos de enerxía renovables
CT1 Capacidade de análise e síntese
CT2 Capacidade de organización e planificación
CT3 Comunicación oral e escrita nas linguas oficiais da Universidade
CT4 Habilidades básicas do manexo do ordenador, relacionadas co ámbito de estudo
CT5 Habilidade na xestión da información (procura e análise da información)
CT6 Resolución de problemas
CT7 Toma de decisións
CT8 Capacidade de traballar nun equipo
CT9 Capacidade crítica e autocrítica
CT10 Compromiso ético
CT11 Capacidade de aprender de forma autónoma e continua
CT12 Capacidade para adaptarse a novas situacións
CT13 Capacidade de xerar novas ideas (creatividade)
CT14 Iniciativa e espírito emprendedor
CT15 Capacidade de aplicar os coñecementos na práctica
CT16 Habilidades de investigación
CT17 Sensibilidade cara a temas ambientais

## Resultados de aprendizaxe

Learning outcomes

Competences

Inclúe todos os resultados de aprendizaxe da titulación, desenvolvendo máis en profundidade un ou outro segundo o foco e a materia específica de cada un dos traballos de Fin de Grao

CB1	CE1	CT1
CB2	CE2	CT2
CB3	CE3	CT3
CB4	CE4	CT4
CB5	CE5	CT5
	CE6	CT6
	CE7	CT7
	CE8	CT8
	CE9	CT9
	CE10	CT10
	CE11	CT11
	CE12	CT12
	CE13	CT13
	CE14	CT14
	CE15	CT15
	CE16	CT16
	CE17	CT17
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	CE37	
	CE38	

## Contidos

### Topic

Dado o seu carácter especial a materia non ten contidos propios, dependerá do tema asignado aona páxina web, pola cal se asignan o TFG e os respectivos Profesores alumno. Dentro da oferta de TFG da Facultade, o Titores. Os traballos poden ser realizados e defendidos en galego, castelán alumno terá a opción de optar por calquera delas.e inglés. Tanto o idioma de realización como o de exposición constarán na acta individual de cada estudante.

## Planificación

	Class hours	Hours outside the classroom	Total hours
Presentación	1	10	11
Lección maxistral	2	0	2
Traballo tutelado	0	282	282
Traballo	2	1	3

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

## Metodoloxía docente

	Description
Presentación	O TFG debe ser defendido ante un tribunal formado por tres profesores da titulación, nos termos establecidos nas normas da Facultade.
Lección maxistral	Dúas horas de clase están reservadas, onde o coordinador da materia de Traballo de Fin de Grao presentará as claves para a elaboración e defensa do TFG.
Traballo tutelado	Como resultado final, presentase un informe axustado ás condicións establecidas nas normas da Facultade.

<http://mar.uvigo.es/index.php/es/alumnado-actual/trabajo-fin-de-grado>

## Atención personalizada

Methodologies	Description
Traballo tutelado	Corresponderalle ao tutor asignado para cada TFG titorizar ao alumno no desenrolo do traballo elexido. O alumno que deberá acudir as titorías personalizadas para resolver dúbidas, principalmente nos horarios que indique o seu titor. Para optimizar o tempo, é necesario que o alumno contacte co profesor con antelación suficiente
Lección maxistral	O profesor coordinador e responsable das sesións maxistrais poderá asesorar e titorizar aos estudantes no que se refire a estrutura, redacción, inclusión de citas e obtención do documento de defensa na aplicación do TFG. O alumno que o desexe poderá acudir a titorías personalizadas para resolver dúbidas, principalmente nos horarios que se indican. Para optimizar o tempo, é necesario que o alumno contacte co profesor con antelación suficien

## Avaliación

Description	Qualification	Evaluated Competences
TraballoAvaliación por parte do titor das competencias desenvolvidas polo alumno no traballo e na redacción da memoria final.  Na normativa de TFG da Facultade pódese atopar en detalle todo o procedemento que debe adoptar o alumno e o seu titor, tanto para a realización do TFG (memoria) como para a súa avaliación.	30	

## Other comments on the Evaluation

O Traballo Fin de Grao (TTG) réxese pola normativa aprobada na Xunta de Facultade e publicada na páxina web do centro.

A Comisión Académica de TFG, con anterioridade ao comezo do traballo, fará públicos os criterios de avaliación que utilizarán tanto o titor para emitir o seu informe como o tribunal para avaliar a memoria do traballo e o seu defensa.

Faranse públicos na páxina web (<http://mar.uvigo.es/index.php/es/alumnado-actual/trabajo-fin-de-grado>) todos os prazos que alcanzan a presentación das memorias, as defensas e a presentación dos informes polos titores. Estes prazos serán aprobados pola Comisión Académica do TFG.

No caso de que o alumno supere a avaliación do Titor e non supere o TFG, o tribunal de avaliación emitirá un informe justificativo. Unha vez atendidas as recomendacións do informe, devandito alumno poderá volver presentar o TFG no período seguinte de avaliación.

Requírese do alumnado que curse esta materia unha conduta responsable e honesta. Considérase inadmisíble calquera forma de fraude (copia ou plaxio) encamiñado a falsear o nivel de coñecementos e destrezas alcanzado en todo tipo de proba, informe ou traballo. As condutas fraudulentas poderán supoñer suspender a materia durante un curso completo. levará un rexistro interno destas actuacións para que, en caso de reincidencia, solicitar a apertura ao reitorado dun expediente disciplinario.

## Bibliografía. Fontes de información

### Basic Bibliography

### Complementary Bibliography

## Recomendacións

### Other comments

Como en todas as materias, o esforzo persoal é esencial, así como atender ás instrucións do titor e entregar o informe no decanato dentro dos prazos establecidos polo Comité Académico de TFG.

Recoméndase ler con atención as normativas relacionadas coa elaboración e defensa do TFG do Centro e toda a documentación relacionada que se pode atopar en <http://mar.uvigo.es/index.php/es/alumnado-actual/trabajo-fin-de-grado>