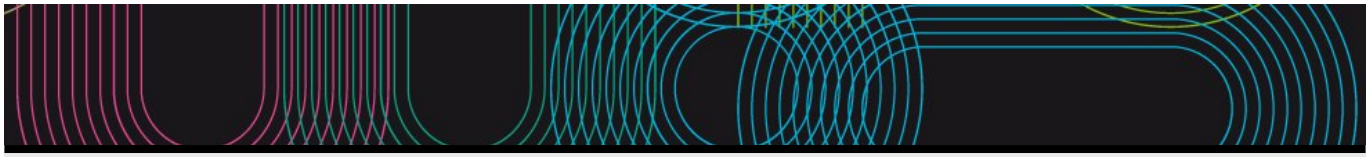

IDENTIFYING DATA				
Marine contamination				
Subject	Marine contamination			
Code	V10G060V01701			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	#EnglishFriendly Galician English			
Department				
Coordinator	Beiras García-Sabell, Ricardo			
Lecturers	Aranguren Gassis, María Beiras García-Sabell, Ricardo Delgado Núñez, Cristina			
E-mail	rbeiras@uvigo.es			
Web	http://www.ecotox.es			
General description	Main pollutants, sources, environmental distribution, toxic effects. Marine environmental legislation.			

Competencies	
Code	
A1	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
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
C4	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
C8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources
C9	To be familiar with the public and private, national and international organizations and institutions related to the Marine Sciences
C14	To recognize and analyze new problems and to propose problem-solving strategies
C16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries
C22	To control marine pollution problems
C26	To plan, direct and write technical reports on marine issues
C30	Identify and assess environmental impacts in the marine environment
C31	Ability to function and operate in public and private, national and international institutions in the field of marine science
C32	Quality control of seafood
C35	Water quality control in water treatment plants
C37	Technical advice or assistance on issues related to the marine and coastal environment
D1	Analysis and synthesis ability
D9	Critical-review and self-criticism capacity
D11	Ability to learn independently and continuously
D15	Ability to apply knowledge in practice
D16	Research skills
D17	Sensitivity towards environmental issues

Learning outcomes				
Expected results from this subject	Training and Learning Results			
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.	A1 A2 A3 A4 A5	B1 B2 B4 B6 B10 B17	C4 C8 C9 C13 C14 C16 C19 C22 C24 C26 C27 C30 C31 C31 C32 C35 C37	D1 D1 D2 D3 D9 D11 D15 D16 D17
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.		B1 B2 B4 B6 B10 B17	C13 C16 C19 C24 C27 C31	D1 D2 D3
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.		B1 B2 B3 B4 B5	C8 C14 C14 C19 C20	D1 D2 D3 D4 D5 D7 D11
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.		B1 B5 B6 B14	C7 C12 C16	
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	A1 A2	B1 B2 B3 B4	C8 C8 C10 C12 C22	D1 D5 D8 D14 D18

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 annoxia. 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 campounds (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: Sorces, distribution, bioaccumulation and biomagnification. Toxicity. Methylmercury. 8. Trace metals II. Copper, lead, cadmium. Sources, concentrations in marine compartments, toxicity. Trobutyltin (TBT).
Ecotoxicology	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. Lisosomal 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 ausence. Biological indices in communities.
Manage¡ing 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, Seaurchin 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.

Planning

	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
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	The theoretical contents that will be evaluated in a final exame will be presented
Seminars	The basic scheme of the seminars consists in the following: 1. preparation by the student of a questionary and a practical case available through TEMA. 2. handing over the questionary 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 ellaborated and handed over to the teacher by the date of the final exame.

Personalized assistance

Methodologies	Description
Lecturing	Power point presentations in the classroom; personal assitance in my office at tutorial times
Laboratory practical	Practical work in the laboratory
Seminars	Questionaire ellaboration and discussion

Assessment

	Description	Qualification	Training and Learning Results		
Lecturing	multiple choice questions exame	70	A1 A2 A3 A4 A5	C8 C9 C14 C16 C22 C31 C32 C35 C37	D1 D9 D11 D16 D17
Seminars	Mandatory presence in the seminars. Delivery of the corresponding individual questionnaires	15		C22	
Laboratory practical	Mandatory presence in the practices and an individual report	15	A1 A2 A3 A4 A5	C4 C26 C31	D15

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**, 5ª 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

Biological oceanography I/V10G060V01502
Biological oceanography II/V10G060V01601

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

*Methods that are not modified:
All with the exception of the field trip of the first session in the practical course. This field trip will be replaced by a laboratory session where samples will be provided by the teachers rather than collected by the students in the field.

*Methods that are modified:
The practical course as above described. If laboratory classes are also impossible then this is replaced by on-line teaching through telematics resources and evaluation will be modified as described below.

*Non-face-to-fase attention to students:
All bilateral communications teacher-student should take place through Skype, in particular the tutorial sessions.

*Modification of teaching contents: none.

*Additional bibliography: none.

=== ADAPTATION OF THE TESTS ===

All evaluations involving exchange of documents (exams, seminar questionnaires) relevant for the final mark will take place if needed using the Virtual Campus.

If the practical course is not possible the weight of the written exam in the final mark will increase from 7 to 8.5 pts and the 1.5 pts of the practical course report will be eliminated.

* Additional Information
During contactless teaching, students must, in these exceptional circumstances, address this issue with responsible and honest conduct. Any form of copying intended to falsify the level of knowledge and skills achieved in the preparation of deliverables, as well as during the virtual examination, will be considered inadmissible. If there is any suspicion of any kind of fraudulent conduct, students may undergo additional verification to verify its veracity.