



## IDENTIFYING DATA

### Marine contamination

Subject	Marine contamination			
Code	V10G061V01401			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	#EnglishFriendly Galician English			
Department				
Coordinator	Beiras García-Sabell, Ricardo			
Lecturers	Beiras García-Sabell, Ricardo Delgado Núñez, Cristina			
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Web	<a href="http://www.ecotox.es">http://www.ecotox.es</a>			
General description	Main pollutants, sources, environmental distribution, toxic effects. Marine environmental legislation.  English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

## 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			
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.			
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
C8	Know the main pollutants, their causes and effects in the marine and coastal environment.			
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			
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.	A2	B2	C8	D1
	A3	B3	C11	D2
	A4	B4		D5
	A5			

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.	A2 A3 A4 A5	B2 B3 B4	C8 C11	D1 D2 D5
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	A2 A3 A4 A5	B2 B3 B4	C8 C11	D1 D2 D5

## 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. Tributyltin (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. 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.

Managing and assessing marine environmental quality	<p>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</p> <p>15. Ecotoxicological bioassays. requirements and methodological aspects. Liquid phase: copepod survival, Seurchin Embryo Test (SET). Solid phase: amphipod survival, bivalve burrowing. In situ bioassays.</p> <p>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.</p> <p>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.</p>
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## Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	40	60
Seminars	12	28	40
Studies excursion	4	0	4
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 two calls, one exam along the course and another at the end.
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. Attendance is mandatory.
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. Attendance is mandatory.
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. Attendance is mandatory.

## Personalized assistance

Methodologies	Description
Lecturing	Power point presentations in the classroom; personal assistance in my office at tutorial times. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.
Laboratory practical	Practical work in the laboratory. Students who wish may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.
Seminars	Questionnaire elaboration and discussion. Students who wish may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.

## Assessment

Description		Qualification	Training and Learning Results			
Lecturing	Multiple choice questions exam. Two tests will be designed: one with 30% along the course and another final with 40% coinciding with the call for 1st opportunity.	70	A2	B2	C8	D1
			A3	B3	C11	D2
			A4	B4		D5
			A5			
Seminars	Mandatory presence in the seminars. Delivery of the corresponding individual questionnaires	15	A2	B2	C8	D1
			A3	B3	C11	D2
			A4	B4		D5
			A5			
Laboratory practical	Mandatory presence in the practices and an individual report	15	A2	B2	C8	D1
			A3	B3	C11	D2
			A4	B4		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 at them 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).**

**2nd opportunity assesment:** All tests performed in continuous evaluation may be recovered at the 2nd opportunity, mantaining the corresponding percentage indicated above.

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

Chemistry applied to the marine environment I/V10G061V01304

Chemistry applied to the marine environment II/V10G061V01309