



IDENTIFYING DATA

Marine contamination

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|---------------------|--|-----------|------|------------|
| 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 | B1 | C4 | D1 |
| | A2 | B2 | C8 | D1 |
| | A3 | B4 | C9 | D2 |
| | A4 | B6 | C13 | D3 |
| | A5 | B10 | C14 | D9 |
| | | B17 | C16 | D11 |
| | | | C19 | D15 |
| | | | C22 | D16 |
| | | | C24 | D17 |
| | | | C26 | |
| | | | C27 | |
| | | | C30 | |
| | | | C31 | |
| | | | C31 | |
| | | | C32 | |
| | | | C35 | |
| | | | C37 | |
| 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 | C13 | D1 |
| | | B2 | C16 | D2 |
| | | B4 | C19 | D3 |
| | | B6 | C24 | |
| | | B10 | C27 | |
| | | B17 | C31 | |
| 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 | C8 | D1 |
| | | B2 | C14 | D2 |
| | | B3 | C14 | D3 |
| | | B4 | C19 | D4 |
| | | B5 | C20 | D5 |
| | | | | D7 |
| 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. | | | | D11 |
| | | B1 | C7 | |
| | | B5 | C12 | |
| | | B6 | 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 | | B14 | | |
| | A1 | B1 | C8 | D1 |
| | A2 | B2 | C8 | D5 |
| | | B3 | C10 | D8 |
| | | B4 | C12 | D14 |
| | | | C22 | 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 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. |

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| Industrial pollutants | <p>5. Hydrocarbons. Oil. Polycyclic Aromatic Hydrocarbons. Sources and weathering of oil in the sea. Effects on marine organisms. Oil spills, lessons learnt.</p> <p>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.</p> <p>7. Trace metals I. Background levels and enrichment factors. Distribution in the oceans. Mercury: Sources, distribution, bioaccumulation and biomagnification. Toxicity. Methylmercury.</p> <p>8. Trace metals II. Copper, lead, cadmium. Sources, concentrations in marine compartments, toxicity. Tributyltin (TBT).</p> |
| Ecotoxicology | <p>9. Distribution of pollutants in the environment. Fugacity models. Environmental persistence and half-life. Biodegradation. Chemical speciation and bioavailability of metals.</p> <p>10. Bioaccumulation. Toxicokinetics. Uptake, accumulation and biotransformation of pollutants in the organisms. Bioconcentration factor (BCF). First order kinetic bioaccumulation models. Thermodynamic bioaccumulation models, K_{ow}.</p> <p>11. Molecular and cellular responses to pollutants: biomarkers. Biotransformation and elimination of toxic chemicals. Lysosomal alterations. Metallothioneins and stress proteins. Cytochrome P450. Enzymatic alterations.</p> <p>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.</p> <p>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.</p> |
| 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, Seaurchin 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> |

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 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. |

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| Laboratory practical | <p>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.</p> <p>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.</p> |
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Personalized assistance

| 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 |

Assessment

| | Description | Qualification | Training and Learning Results | | |
|----------------------|---|---------------|-------------------------------|---|-------------------------------|
| Lecturing | multiple choice questions exam | 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**, 5^a 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-face 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.
