



| Teaching Guide      |                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                                                   |         |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------|---------|
| Identifying Data    |                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                                                   | 2019/20 |
| Subject (*)         | Ecotoxicology                                                                                                                                                                                                                                                                                                                                                                                                                      | Code   | 610G02042                                         |         |
| Study programme     | Grao en Bioloxía                                                                                                                                                                                                                                                                                                                                                                                                                   |        |                                                   |         |
| Descriptors         |                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                                                   |         |
| Cycle               | Period                                                                                                                                                                                                                                                                                                                                                                                                                             | Year   | Type                                              | Credits |
| Graduate            | 1st four-month period                                                                                                                                                                                                                                                                                                                                                                                                              | Fourth | Optional                                          | 6       |
| Language            | Spanish                                                                                                                                                                                                                                                                                                                                                                                                                            |        |                                                   |         |
| Teaching method     | Face-to-face                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                                                   |         |
| Prerequisites       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                                                   |         |
| Department          | Bioloxía                                                                                                                                                                                                                                                                                                                                                                                                                           |        |                                                   |         |
| Coordinador         | Barreiro Lozano, Rodolfo                                                                                                                                                                                                                                                                                                                                                                                                           | E-mail | rodolfo.barreiro@udc.es                           |         |
| Lecturers           | Barreiro Lozano, Rodolfo<br>Barrientos De La Llana, Sara                                                                                                                                                                                                                                                                                                                                                                           | E-mail | rodolfo.barreiro@udc.es<br>sara.barrientos@udc.es |         |
| Web                 |                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                                                   |         |
| General description | This subject studies the effects of pollutants on organisms. This study includes (i) the analysis and detection of these effects and (ii) the prediction of the possible damage that pollutants may cause. A substantial portion of the contents is devoted to biomonitoring (i.e. using the organisms themselves to detect pollution), a tool that has become increasingly important for environmental protection and management. |        |                                                   |         |

| Study programme competences / results |                                                                              |
|---------------------------------------|------------------------------------------------------------------------------|
| Code                                  | Study programme competences / results                                        |
| A9                                    | Identificar e utilizar bioindicadores.                                       |
| A17                                   | Realizar bioensaios e diagnósticos biolóxicos.                               |
| A21                                   | Deseñar modelos de procesos biolóxicos.                                      |
| A23                                   | Avaliar o impacto ambiental. Diagnosticar e solucionar problemas ambientais. |
| B1                                    | Aprender a aprender.                                                         |
| B4                                    | Traballar de forma autónoma con iniciativa.                                  |
| B6                                    | Organizar e planificar o traballo.                                           |
| B7                                    | Comunicarse de maneira efectiva nunha contorna de traballo.                  |
| B8                                    | Sintetizar a información.                                                    |
| B9                                    | Formarse unha opinión propia.                                                |
| B10                                   | Exercer a crítica científica.                                                |
| B11                                   | Debater en público.                                                          |

| Learning outcomes                                                                                                      |                                       |           |  |
|------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------|--|
| Learning outcomes                                                                                                      | Study programme competences / results |           |  |
| Distinguir e identificar as técnicas de ecotoxicología retrospectiva e prospectiva                                     |                                       | B9        |  |
| Describir os efectos habituais da contaminación en individuos, poboacións e comunidades                                | A9<br>A17<br>A23                      |           |  |
| Valorar as vantaxes e limitacións de cada nivel de organización para detectar o impacto contaminante                   |                                       | B9<br>B10 |  |
| Comprender os resultados de técnicas básicas de ensaio de toxicidade, estudos de acumulación-depuración, biomarcadores | A9<br>A17<br>A21                      |           |  |
| Describir os mecanismos polos que un organismo fai fronte aos contaminantes.                                           | A21                                   | B1<br>B4  |  |



|                                                                                                |     |                                                |  |
|------------------------------------------------------------------------------------------------|-----|------------------------------------------------|--|
| Valorar críticamente a relevancia da información derivada de ensaios de toxicidade             | A17 | B9<br>B10                                      |  |
| Valorar críticamente as predicións de modelos de distribución e efectos de contaminantes       | A23 | B9<br>B10                                      |  |
| Realizar unha procura bibliográfica dun tópico ecotoxicolóxico e resumir a información obtida  |     | B1<br>B4<br>B6<br>B7<br>B8<br>B9<br>B10<br>B11 |  |
| Enfrontarse á literatura especializada podendo encadrala nun tópico concreto da ecotoxicología |     | B1<br>B4<br>B8<br>B9<br>B10                    |  |

| Contents                                                                |                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic                                                                   | Sub-topic                                                                                                                                                                                                                                                                           |
| Introduction                                                            | Human population growth.<br>Major environmental problems in Europe.<br>Ecotoxicology.                                                                                                                                                                                               |
| Pollutants                                                              | Major types and features<br>Inorganic pollutants: metals and anions<br>Organic pollutants<br>Organometals<br>Gases                                                                                                                                                                  |
| Toxicokinetics                                                          | Mechanisms for pollutant accumulations.<br>Uptake.<br>Biotransformation and detoxification of metals and metaloids.<br>Biotransformation of organic pollutants.<br>Excretion.<br>Bioaccumulation Factor (BAF), Bioconcentration Factor (BCF), and Accumulation Factor.<br>Kinetics. |
| Bioamplification along the trophic chain                                | Bioamplification.<br>Trophic transfer and Bioamplification factor.<br>Examples of bioamplification in metals and organic pollutants.                                                                                                                                                |
| Bioaccumulation and pollutant detection (Retrospective Ecotoxicology I) | Bioavailability.<br>Factors of pollutant bioavailability.<br>Use of bioaccumulators.<br>Requisites of a good bioaccumulator.                                                                                                                                                        |
| Toxicodynamics: biochemical and histological effects                    | Protective and non protective biochemical changes.<br>Molecular toxicity mechanisms.<br>Modes of toxic actions in organic pollutants.<br>Examples of molecular mechanisms.<br>Cytotoxicity and necrosis.<br>Damage to genes and chromosomes.                                        |



|                                                                     |                                                                                                                                                                                                          |
|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Physiological effects                                               | Sublethal effects.<br>Effects on growth, development, reproduction, physiology and behaviour.<br>Trade-off between detoxification and production.                                                        |
| Biomarkers (Retrospective Ecotoxicology II).                        | Classification, especificity and relationship with damaging effects.<br>Requisites of a good biomarker.<br>Examples of biomarkers.<br>Use of biomarkers.                                                 |
| Toxicity assays (Porspective Ecotoxicology I).                      | Dose-response relationship.<br>Types of assays.<br>Data analyses.<br>Toxicity curves, mean lethal time and threshold LC50.<br>Data analyses in chronic assays: NOEC, LOEC y MATC.<br>Application Factor. |
| Prediction (Prospective Ecotoxicology II)                           | Prediction at individual level: QSAR.<br>Prediction at ecosystem level: SSR.                                                                                                                             |
| Changes in community composition (Retrospective Ecotoxicology III). | Indicator species.<br>Relative abundance.<br>Saprobic systema and biotic indexes.<br>Diversity.<br>Comparisson with reference communities.                                                               |

**Planning**

| Methodologies / tests          | Competencies / Results       | Teaching hours (in-person & virtual) | Student?s personal work hours | Total hours |
|--------------------------------|------------------------------|--------------------------------------|-------------------------------|-------------|
| Guest lecture / keynote speech | A9 A23 B8 B9                 | 24                                   | 84                            | 108         |
| Laboratory practice            | A17                          | 5                                    | 0                             | 5           |
| ICT practicals                 | A21 A23                      | 10                                   | 0                             | 10          |
| Seminar                        | B1 B4 B6 B7 B8 B9<br>B10 B11 | 7                                    | 17.5                          | 24.5        |
| Multiple-choice questions      | A9 A17 A21 A23               | 1                                    | 0                             | 1           |
| Personalized attention         |                              | 1.5                                  | 0                             | 1.5         |

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

**Methodologies**

| Methodologies                  | Description                                                                                                                                                           |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Guest lecture / keynote speech | Clases maxistras con apoio de información gráfica a disposición dos alumnos a través de Moodle.                                                                       |
| Laboratory practice            | Sesiones de prácticas bajo la dirección del profesor y con apoyo de guion que detalla de manera exhaustiva los ejercicios a realizar (también disponibles en Moodle). |
| ICT practicals                 | Sesiones de prácticas bajo la dirección del profesor y con apoyo de guión que detalla de manera exhaustiva los ejercicios a realizar (también disponibles en Moodle). |
| Seminar                        | Seminarios con resolución de problemas e análises de bibliografía.                                                                                                    |
| Multiple-choice questions      | Exame do programa de teoría.                                                                                                                                          |

**Personalized attention**

| Methodologies | Description                                                     |
|---------------|-----------------------------------------------------------------|
| Seminar       | Resolución de dúbidas nos horarios de tutorías correspondentes. |



| Assessment                |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |
|---------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Methodologies             | Competencies / Results       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Qualification |
| Laboratory practice       | A17                          | A asistencia ás prácticas é obrigatoria. Cada día de ausencia non xustificada ás prácticas supón 0.5 puntos menos na cualificación final.                                                                                                                                                                                                                                                                                                                                                                 | 0             |
| Multiple-choice questions | A9 A17 A21 A23               | o Coñecementos adquiridos nas clases de teoría.<br>o Exame tipo test multiopción.                                                                                                                                                                                                                                                                                                                                                                                                                         | 70            |
| Seminar                   | B1 B4 B6 B7 B8 B9<br>B10 B11 | Primeira oportunidade: Exposición dun traballo de revisión bibliográfica na última sesión de seminarios.<br><br>Segunda oportunidade: os alumnos que non expuxesen o traballo de revisión bibliográfica na primeira oportunidade poderán presentar o traballo por ESCRITO na data do exame da segunda oportunidade (as normas detalladas para presentar o traballo están dispoñibles en Moodle). Os TRABALLOS PRESENTADOS NA SEGUNDA OPORTUNIDADE PODEN ACADAR UNHA CUALIFICACIÓN MÁXIMA DE 5 (aprobado). | 30            |
| ICT practicals            | A21 A23                      | A asistencia ás prácticas é obrigatoria. Cada día de ausencia non xustificada ás prácticas supón 0.5 puntos menos na cualificación final.                                                                                                                                                                                                                                                                                                                                                                 | 0             |

#### Assessment comments

Para aprobar a materia é REQUISITO IMPRESCINDIBLE superar o exame de teoría cunha cualificación de polo menos 4. NO CASO CONTRARIO SUSPÉNDESE A MATERIA CON INDEPENDENCIA DAS RESTANTES CUALIFICACIÓNS e porase a nota numérica máis baixa de (i) a nota media coas porcentaxes anteriores ou (ii) a nota do exame de teoría).

Non asistir ao exame de teoría implica a cualificación final de NON PRESENTADO.

#### Sources of information

|                      |                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Basic</b>         | <ul style="list-style-type: none"> <li>- Walker, C. H., S. P. Hopkin, R. M. Sibly, and D. B. Peakall. (2006). Principles of Ecotoxicology, 3rd edition. Taylor &amp; Francis, London</li> <li>- Newman, M. C. (2010). Fundamentals of Ecotoxicology, 3 edition. CRC Press</li> <li>- Newman, M. C.; Clements, W.H. (2008). Ecotoxicology: A Comprehensive Treatment. CRC Press</li> </ul> |
| <b>Complementary</b> | La bibliografía básica es suficiente para una asignatura de licenciatura. Además, el alumno debe buscar trabajos científicos para realizar el trabajo tutelado; los trabajos concretos varían para cada alumno.                                                                                                                                                                           |

#### Recommendations

Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus

#### Other comments

Recoméndase aos alumnos facer uso das titorías para resolver dúbidas co profesor.

(\*The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.