

MATERIA

**POLLUTION IN ESTUARIES: PAST, PRESENT AND FUTURE**

**Objetivos específicos de aprendizaje.**

**PART 1. Geology of the Estuarine Areas (Bay of Biscay)**

Aims

To give a broad knowledge on both the geological evolution of estuarine areas during the Quaternary and the methods to investigate naturally and anthropogenically induced changes on these environments.

Objectives

At the end of the unit, you should:

Be able to identify sediments found in different estuarine environments and to understand the basic sedimentary processes leading to their deposition

Be able to describe the main geological techniques for investigating the coastal geological record.

Be able to analyse different proxies contained within the estuarine sediments.

Be able to understand the driving forces (natural and anthropogenic) responsible of the estuarine environmental evolution through time.

Key Skills Acquired

Geological field and laboratory techniques

Problem analysis and critical evaluation

Written communication and presentation of data

**PART 2. Degradation and rehabilitation of estuarine ecosystems**

Aims

To provide a basic knowledge on estuarine ecosystems, including why estuaries are important for humans, procedures to assess the health of estuaries, and the scientific advice in the management of estuaries.

To develop the concepts of estuarine ecosystem health, vulnerability to human activities, and sustainable utilization.

Objectives

*At the end of the course you should be able to:*

Understand the basic concepts of estuarine ecology, and the main differences between estuaries

Identify the important functions of estuaries, including benefits to humans, the factors that affect estuarine health and the actions that can be taken to improve the health of estuaries

Have gained knowledge of the procedures and tools to assess the health of estuaries, prevent deterioration of healthy systems, and rehabilitate deteriorated systems.

Key Skills Acquired

Ability to access scientific and institutional information (paper and online literature)

Written reporting

Oral presentation and discussion

In situ recording of environmental data in water and sediments

Data treatment methods

**Metodología docente: actividades de aprendizaje y su valoración en créditos ECTS (horas).**

**Actividades de aprendizaje.**

Part 1.  
Learning & Teaching  
Formal Lectures: 3 days (7 hours)  
Fieldtrip: visit to estuarine locations and collection of samples, 2 days (12 hours)  
Practical Laboratory Sessions: analysis of samples, 8 days (16 hours)

Part 2  
Learning & Teaching  
Formal Lectures  
Sessions for literature data search and reporting  
Boat work recording environmental data  
Practical session for field data treatment and interpretation

**Programa de la asignatura.**

<b>PART 1</b>	<b>Geology of the Estuarine Areas (Bay of Biscay)</b>
<b>TEMA 1</b>	Description of the geological nature of the estuarine areas in the Bay of Biscay showing the contrast between the sedimentary character of the sandy eastern margin and the erosive character of the rocky southern margin
<b>TEMA 2</b>	Summary of the current knowledge on the Quaternary evolution of these estuarine areas based on the multiproxy geological record preserved in different environments like tidal flats, marshes and dunes
<b>TEMA 3</b>	Analysis of the recent anthropogenic impact on these estuarine areas in terms of physical, chemical and biological changes through time
<b>TEMA 4</b>	Presentation of selected environmental regeneration case studies.
<b>PRÁCTICA 1</b>	Field trip to visit estuarine locations and to collect samples
<b>PRÁCTICA 2</b>	Geological analysis of samples
<b>PART 2</b>	<b>Degradation and rehabilitation of estuarine ecosystems</b>
<b>TEMA 1.</b>	Estuarine ecology: estuary definition, classifications, environmental features, habitats, communities and processes.

TEMA 2	The use of estuaries by man: description of estuarine resources, including naturalistic and recreational values, and main human activities from a historical perspective.
TEMA 3	Assessment of the human impact in estuaries: physical perturbation and pollution, and their effects.
TEMA 4	Approach to estuarine management, with particular emphasis on strategies and methods for restoration, conservation, monitoring, and sustainable utilization of estuaries.
PRÁCTICA 1	Elaboration of a technical report on a particular estuary describing environmental and biological characteristics, main resources and uses, major problems and possible solutions
PRÁCTICA 2	Fieldwork to identify a particular environmental problem in a humanised estuary.

**Bibliografía.**

- Cearreta, A.; Irabien, M.J.; Leorri, E.; Yusta, I.; Croudace, I.W. y Cundy, A.B. (2000). Recent Anthropogenic Impacts on the Bilbao Estuary, N. Spain: Geochemical and Microfaunal evidence. *Estuarine Coastal and Shelf Science*, 50, 571-592.
- Cearreta, A.; Irabien, M.J.; Leorri, E.; Yusta, I.; Quintanilla, A. y Zabaleta, A. (2002). Environmental transformation of the Bilbao estuary: microfaunal and geochemical proxies in the recent sedimentary record. *Marine Pollution Bulletin*, 44, 487-503.
- Cearreta, A.; Irabien, M.J. y Pascual, A. (2004). Human activities along the Basque coast during the last two centuries: geological perspective of recent anthropogenic impact on the coast and its environmental consequences. In: A. Borja y M. Collins (eds.), *Oceanography and Marine Environment of the Basque Country*, Elsevier Oceanography Series, 70, 27-50. Amsterdam.
- Attrill M.J. 1998. A. Rehabilitated Estuarine Ecosystem. The environment and ecology of the Thames Estuary. Kluwer Academic Publishers, London, UK
- Davidson NC, D d'A Laffoley, JP Doody, LS Way, J Gordon, R Key, CM Drake, NW Pienkowski, R Mitchell & KL Duff. 1991. Nature conservation and estuaries in Great Britain. Nature Conservancy Council. Peterborough PEI IUA
- Day JW, CgAS Hall, WM Kemp & A Yáñez-Arancibia. 1989. *Estuarine Ecology*. Wiley Interscience. US
- Kennish MJ. 1992. *Ecology of Estuaries: Anthropogenic Effects*. CRC Press. Inc., US
- Kennish MJ. 1999. *Estuary Restoration and Maintenance: The National Estuary Program*. CRC Press. Inc., US
- McLusky DS. 1990. *The Estuarine Ecosystem*. Chapman & Hall, New York, USA
- Newman MC, MH Roberts & RC Hale. 2001. *Coastal and Estuarine Risk Assessment*. Lewis Publishers, US
- Wilson JM. 1988. *The Biology of Estuarine Management*. Croom Helm, New York

### **Criterios y métodos de evaluación.**

- La asistencia es obligatoria, considerándose la misma como criterio de evaluación.
- Se tendrá en cuenta así mismo la participación en las actividades del curso;
- Debe entregarse un informe que incluye un cuestionario sobre el curso, un resumen de dos páginas de extensión máxima en el que opcionalmente se cuestionen bien aspectos del curso en general o bien alguna temática concreta que haya resultado de especial interés para alumno.
- Debe entregarse, asimismo un cuaderno de prácticas donde el alumno haya realizado sus anotaciones, para poder evaluar el aprovechamiento de las mismas.

#### Assessment

PART 1 (50%): Written examination to test the theoretical part of the unit (50%) and written report to evaluate the practical activities (50%).

PART 2 (50%): Written examination based on the lectures 60% + Assessment of the oral presentation of the technical report based on literature analysis 25% + Fieldwork assessment 15%

### **Recursos para el aprendizaje.**

Equipamiento audiovisual departamental y de la facultad.  
Laboratorio de análisis de muestras.  
Equipos de muestreo.  
Sala de ordenadores de la facultad.  
Recursos bibliográficos.  
Recursos vía Internet.

### **Vinculación de la materia a códigos UNESCO**

CÓDIGO	UNESCO
2401	BIOLOGÍA ANIMAL (ZOOLOGÍA)
2414	MICROBIOLOGÍA
2417	BIOLOGÍA VEGETAL (BOTÁNICA)
2506	ZOOLOGÍA