Course Title: COASTAL ECOLOGY AND FUNCTIONING 5UM12

Main topic: Ecology and functions of marine sediments

Credits: 6 ECTS

Keywords: FUNCTIONAL ECOLOGY, BENTHIC-PELAGIC COUPLING, BIOGEOCHEMISTRY, ORGANISM-SEDIMENT RELATIONS, ECOSYSTEM ENGINEER SPECIES, COASTAL ECOSYSTEMS, HUMAN THREATS.

Students can access to regular update of the course content at:

http://lecob.obs-banyuls.fr/en/education/teaching/imbr-sea-courses.html

Position of the course:

Coastal areas are among the most diversified and productive ecosystems on earth and deliver a wide range of socioeconomic services to humans, but are highly vulnerable. Their functioning is governed by a set of ecological and biogeochemical processes linked by complex and poorly defined interactions. An integrated understanding of these processes and their interactions is needed to apprehend the dynamic of coastal ecosystems, predict their response to anthropogenic disruption and insure a sustainable management of coastal areas. This course will focus on marine soft-sediments, which provide the largest habitat on Earth planet.

The course is designed to provide students with an integrated view of the major ecological processes in coastal marine sediments, with a special focus on how these processes impact carbon and nitrogen cycling. The course provides multidisciplinary conceptual and methodological competencies at the boundary between marine chemistry, biogeochemistry and benthic ecology.

This course is intended for students who want to embrace an academic career as well as those who intend to be involved in environmental management of the littoral and need a good knowledge of coastal ecosystem functioning. Key concepts developed in this course may be applied to other environments such as abyssal ecosystems.

Course content:

This course provides a good background for anyone you want to study benthic ecology in coastal systems and underlines the particularities of the Mediterranean Sea. The major topics of the course include: pelagic primary production, benthic/pelagic coupling, sediment-organism interactions, and early diagenesis. Practical works will illustrate the concepts acquired during the course. Current literature will be used to encourage students to integrate lecture topics and achieve a comprehensive understanding of how biogeochemical processes serve to regulate ecosystem functions in these diverse habitats. Discussions will also focus on the anthropogenic influence on the estuarine ecosystem.

We will:

- Describe the key ecological and biogeochemical processes controlling coastal ecosystem functions,

- Understand the global significance of bentho-pelagic coupling in coastal environments,

- Assess the functional role of macro- and meiobenthos on this coupling and on the fate of organic matter in marine sediments (ecosystem engineer species, early diagenesis)

Initial competences required:

Basic knowledge in marine biology and oceanography

Final competences acquired:

Students will acquire **transferable tools** such as methods used for the monitoring of the environment: extraction of meiofauna and biomass estimation, characterisation of marine sediments, performing mesocosm experiments, use of chemical sensors, and measurement of benthic fluxes…

By the end of the course students will understand: (1) what are the main processes that govern marine ecosystem functioning in coastal waters; (2) how marine organisms affect these processes; (3) how to study the bentho-pelagic coupling in coastal ecosystems.

Most important students will know how to use these new competencies to manage and protect marine coastal environments.

Teaching methods:

Lectures will put an emphasis on the coupling between pelagic and benthic ecosystems, and on how organism-sediment interactions impact benthic biogeochemistry and coastal functions.

The key concepts presented during the lectures will be illustrated with two practical works including experiments and analyses performed by the students in the research laboratories of the Benthic ecogeochemistry group.

PW1: Bentho-pelagic coupling

PW2: Fate of organic matter in marine sediments.

Learning material:

Lectures and conferences (18 hours).

Practical lab works involving experiments and biochemical analyses (30h): (1) to describe the physical and chemical properties of the sedimentary ecosystems (grain size, porosity, organic matter composition, lipid biomarkers, oxygen concentration), (2) to illustrate the response of the benthic compartment to a pulse of fresh organic matter, and (3) to study the influence of benthic organisms on carbon cycling.

Following the practical works, students, with the help of the teaching team, will critically interpret their results and complete their work with some recent publications (12h). This tutorial work will help the student acquire a conceptual understanding of the ecological and biogeochemical processes occurring at the benthic-pelagic boundary.

References:

Recent scientific papers will be provided to the students to complete the lectures-practical-tutorial sessions. These publications will show how the concepts and methods learnt in the course are applied in art-to-date science.

No class book is required for the course, but books are provided to students.

Students may read:

- Ecology of marine sediments 2nd edition by J.S. Gray & M. Elliot 2009
- Mediterranean Ecosystems: Structures and Processes by F. Faranda, L. Guglielmo and G. Spezie 2001
- Biogeochemistry of estuaries by T. Bianchi 2006

- Marine Biology by J.S. Levinton 2001
- Ecology of Coastal Waters: With Implications For Management by K.H. Mann 2009
- Global coastal change by I. Valiela 2009
- Le golfe du Lion by A. Monaco et al. 2009
- Meiobenthology: The Microscopic Motile Fauna of Aquatic Sediments by O. Giere 2008

Evaluation methods:

Oral presentation of the personal project (40%) and a final written examination (60%).

Examination methods:

Students will work per binome and present one of the experimental work they have performed during the course. They will interpret their results with a critical mind, and present scientific publications on the same topic and/or using the same approach.

Calculation of the examination mark:

Oral presentation of the personal project (40%)

Final written examination (60%)

Teachers involved in the course:

(List the teacher's name who will participate in the course).

First name:	**Last name:**	**Function (responsible teacher / co-teacher)**
Audrey	Pruski	Responsible teacher
Orignac	Jadwiga	Responsible teacher
François	Lantoine	Co-teacher
Le Bris	Nadine	Co-teacher
Méjanelle	Laurence	Co-teacher

Course Facilities

Classroom with projection
Class resources available on a dedicated MOODLE web site (pdf of lectures and printed laboratory manuals, forum)
E-learning classroom
WIFI access
Library access on site
Laboratories with scientific equipment (gas chromatographs, spectrofluorimeter,laser granulometer, microsensors …)
Oceanographic vessel with sampling equipment

On site facilities for accommodation and institutional catering