

An international Programme for ERASMUS+ exchange students
dedicated to environmental science and coastal management

WADDEN SEA

DYNAMIC SYSTEM AND NATURE HERITAGE

MODULE HANDBOOK



Course table - Module description



COMPULSORY MODULES

Module 1:

1st part: Wadden Sea – Programme introduction

- Excursion to the Wadden Sea Island Spiekeroog
- German language course Consolidation of the results from the specialization modules

2nd part: Wadden Sea – Programme synopsis

- Seminar - Synthesis and consolidation of the results
- Seminar - Progress in Wadden Sea research – Seminar presentation

Module 2:

Dynamics of the Wadden Sea world heritage site

- Wadden Sea - World nature heritage site
- Wadden Sea biotopes and nature conservation
- Wadden Sea oceanography

SPECIALIZATION MODULES

(choose one module)

Module 3:

Wadden Sea – Sedimentary processes and biodiversity

(go for 18 ECTS out of 22 ECTS)

- Sediment microbiology
- Microbial ecology
- Biological significance of suspended matter
- Consequences of biodiversity change
- Dangerous marine animals: Biology, ecology and first aid
- Microbial excursion *or*: Excursion to the offshore island of Helgoland

Module 4:

Wadden Sea – Wadden Sea – Ecosystem based management

- International research workshop: water and coastal management
- Economics and climate change
- International environmental management
- Case Studies in Coastal Management
- Nature conservation in practice
- Estuarial Cities: Bremen and the River Weser

Wadden Sea – Programme Introduction and Synopsis

6 Credit points

Assessment:	Oral presentation incl. discussion
Managing lecturer:	Esser
Lecturers:	Mose, Klenke, Freund, Junge and a group of other lecturers of the programme
Prerequisites/corequisites:	none

TOPICAL CLASSES, MODES OF TEACHING:

1st part: Wadden Sea – Programme introduction:
Excursion to the Wadden Sea Island Spiekeroog (1 ECTS); German language course Consolidation of the results from the specialization modules (2 ECTS)

2nd part: Wadden Sea – Programme synopsis:
Wadden Sea – Programme synopsis Seminar - Synthesis and consolidation of the results (1 ECTS); Seminar - Progress in Wadden Sea research – seminar presentation (2 ECTS)

AIMS AND CONTENT

- to socialise with students and staff
- to provide an overview of keys of the Wadden Sea heritage
- to synthesise fragmented facts and results of individual studies of the exchange students
- to provide a forum for the exchange students to communicate own work with other students and an experienced audience.

LEARNING OUTCOMES

- Students will be enabled to understand and apply advanced conceptual frameworks covered in the module to interpret coastal dynamic systems.
- Students will have an advanced understanding of and be able to interpret the interactions between human and 'natural' environmental processes.
- Students will be able to demonstrate a good grasp of the challenges involved in the interdisciplinary

study of coastal systems and transdisciplinary approaches to the management of such systems.

- Students will develop skills in the interpretation and application of conceptual frameworks for understanding dynamic ecosystems and human impacts on such systems through individual work on case studies.
- Students will be able to apply the ideas covered in the course to formulate proposals for intervention strategies or research in science based coastal management.
- Students will understand how concepts and theories of environmental sciences and coastal management have been tested empirically using different approaches to formulate a sound conceptual framework, suitable to undertake a master's level dissertation focused on a specific aspect of fundamental ecosystem research or ecosystem based management.
- Students will be familiar with the German university system.
- Students will have basic knowledge of the German language.
- Students will be enabled to debate ideas, while recognizing and respecting the viewpoints of others.
- Students will be trained in verbal presentation and written communication.
- Students will be trained in team work in a workshop format.

Dynamics of the Wadden Sea World Heritage Site

6 Credit Points

Assessment:	Written thesis
Managing lecturer:	Freund
Lecturers:	Stanev, Mose, Massmann, Giani
Prerequisites/corequisites:	none

TOPICAL CLASSES, MODES OF TEACHING

Wadden Sea - World nature heritage site / Excursion to the Wadden Sea Island Spiekeroog (1 ECTS); Wadden Sea biotopes and nature conservation (German language course) (2 ECTS); Wadden Sea oceanography - Synthesis and consolidation of the results (3 ECTS)

AIMS AND CONTENT

The module is

- to focus the Wadden Sea as a World Natural Heritage Site and the means of protection connected with this international status of UNESCO
- to focus the to focus biodiversity of the unique Wadden Sea ecosystem including physiological processes
- to consider biodiversity as foundation of nature conservation and management
- to be familiarised with the interrelation of biotopes and geotopes and soil-water interactions
- to focus the flow of energy and matter in the Wadden Sea basins and the exchange with the open North Sea, respectively
- to reflect on recent results of coastal environmental studies and modelling.

LEARNING OUTCOMES

- Students will understand the character of UNESCO World Natural Heritage Sites and the challenges connected with this status

- Students will be enabled to understand and apply advanced biological and physico-chemical frameworks covered in the module to interpret coastal bio-physical dynamic systems.
- Students will have an advanced understanding of and be able to interpret the interactions between human and fundamental environmental processes of the Wadden Sea.
- Students will have an advanced understanding of analytical methods and models in coastal environmental sciences.
- Students will be able to apply knowledge introduced in the course to formulate opinions on research for science based coastal management.
- Students will understand concepts and theories of environmental sciences, in particular in the field of biodiversity, ecosystem services and complex systems.
- Students will be enabled to work with scientific literature.
- Students will be trained in written communication.



Wadden Sea / © Carl von Ossietzky Universität Oldenburg- ICBM

Wadden Sea – Sedimentary processes and biodiversity

18 Credit points (out of 22)

Assessment:	Written tests (or several short tests) about the contents of the lectures. Mandatory are one practical course and one seminar.
Managing lecturer:	Cypionka / Schupp
Lecturers:	Engelen, Cypionka, Vandieken, Schupp, Striebel
Prerequisites/corequisites:	For the practical course „Microbial ecology of marine sediments” Lecture: „Sediment Microbiology”

TOPICAL CLASSES, MODES OF TEACHING

Sediment microbiology (3 ECTS); Microbial ecology (3 ECTS); Biological significance of suspended matter (3 ECTS); Consequences of biodiversity change (3+6 ECTS); Dangerous marine animals: Biology, ecology and first aid (3 ECTS); Microbial excursion or: Excursion to the offshore island of Helgoland (1 ECTS)

AIMS AND CONTENT

Sediment microbiology

This lecture presents state of the art knowledge about occurrence, life and activities of microorganisms in these environments. Physiological issues are addressed as well as evolutionary and applied aspects.

Topics are:

- Formation, diagenesis and special features of sediments
- physico-chemical conditions and geological records
- interpretation of gradients
- microbes and biological processes in sediments
- methods for cultivation of sediment organisms
- molecular methods
- biogeochemical methods
- quantification of prokaryotes and viruses.

Microbial ecology of marine sediments

Learning target/competences: Physico-chemical conditions, microbial processes and methods of studying

these processes in sediments. Intensive description of a several meter long sediment core from a North Sea tidal flat. Sediment sampling, measurement of geochemical profiles, cell counts, molecular quantification of phylogenetic and physiological groups and cultivation of various phenotypes from different sediment horizons. The experiments are carried out, typically in groups of two students guided by a teacher or PhD student. The seminar will be held by the students to introduce the other students into the specific physiologic guild they are working with. The results are documented and discussed in a protocol fulfilling scientific level requirements.

Microbial ecology

Principles of biogeochemistry, global element cycles, mineralization of organic substances, chemotaxis, aquatic habitats, terrestrial habitats, deep subsurface biosphere, syntrophy and symbiosis, microbes in earth history, methods in microbial ecology, isotope fractionation, applied microbiology, bioremediation

Biological significance of suspended matter

Origin, classification and distribution in waters analytics, transport and sedimentation, aggregation and aggregate formation mechanisms, case studies of aggregation events, microbial colonization, microbial metabolism activity, structural analysis of aggregate-associated bacterial communities.

Micobiology excursion to companies and scientific institutions guided by Prof. H. Cylpionka, Prof. M. Simon.

Excursion to the offshore island of Helgoland with their unique rocky flats and kelp forests (Helgoländer Felswatt), guided by Prof. P. Schupp, Dr. S. Rohde.

LEARNING OUTCOMES

Sediment microbiology

Introduction into sediment microbiology including anaerobic processes, energy metabolism, cultivation of sediment bacteria, adaptation to environmental conditions, molecular biological methods, quantification of microorganisms and sampling at sea.

Microbial ecology of marine sediments

The students know how to

- sample marine sediments
- characterize the cores sedimentologically and biogeochemically
- collect and analyze porewater

- determine total cell counts
- quantify groups of organisms molecular biologically
- cultivate different physiological groups of bacteria
- present and discuss scientific results
- write a scientific protocol.

Microbial ecology (VL/Ü)

They know the basics of microbial ecology and the biogeochemistry of important microbial habitats. They know molecular and chemical-analytical methods of microbiology. They have experience with the field study of microorganisms.

Biological significance of suspended matter

The students know the basics of microbial ecology and the biogeochemistry of important microbial habitats with particular emphasis on the ecology of suspended matter.

Sediment sampling Wadden Sea © Carl von Ossietzky Universität Oldenburg - M. Beck (ICBM)





SPECIALIZATION MODUL

Wadden Sea – Ecosystem based management

18 Credit points

Assessment:	Written thesis (or several short tests) about the contents of the lectures
Managing lecturer:	Freund
Lecturers:	Mose, Siebenhüner, Karrasch, Klenke
Prerequisites/corequisites:	none

TOPICAL CLASSES, MODES OF TEACHING

International research workshop: water and coastal management (6 ECTS) Economics and climate change (3 ECTS); International environmental management; (3 ECTS); Case Studies in Coastal Management (3 ECTS); Nature conservation in practice (1,5 ECTS); Estuarial Cities: Bremen and the River Weser (1,5 ECTS)

AIMS AND CONTENT

The module is

- to focus current issues of spatial development in the international Wadden Sea region (Germany, Netherlands)
- to focus global threats of climate change and their economic implications
- to focus the demand for an integrated coastal zone management on the basis of selected case studies from the Wadden Sea
- to focus concepts, strategies and instruments of nature
- conservation in an European context
- to focus current issues of river development and
- water management in urban environments by the example of the City of Bremen.

LEARNING OUTCOMES

- Students will have an advanced understanding of fundamental conceptual frameworks, strategies and instruments for environmental management particularly suitable for coastal areas
- Students will get to know and reflect applied management approaches by investigating selected case studies and related actors in a coastal and river context
- Students will be enabled to debate different conceptual ideas, while recognizing and respecting the viewpoints of others.
- Students will be trained in verbal presentation and written communication.
- Students will be trained in team work in a workshop format.