GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2025-2026

Marine Ecology (C003874)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 150 h**

Course offerings and teaching methods in academic year 2025-2026

A (semester 1)	English	Gent	lecture
			seminar

Lecturers in academic year 2025-2026

Van Colen, Carl	WE11	lecturer-in-charge
Macheriotou, Lara	WE11	co-lecturer
Pasotti, Francesca	WE11	co-lecturer
Vafeiadou, Anna-Maria	WE11	co-lecturer

Offered in the following programmes in 2025-2026	**crdts**	**offering**
Master of Science in Teaching in Science and Technology(main subject Biology)	6	A
International Master of Science in Marine Biological Resources	6	A
Master of Science in Biology	6	A
Exchange Programme in Biology (master's level)	6	A

Teaching languages

English

Keywords

Position of the course

The course on marine ecology presents advanced topics on the ecology of marine biodiversity and ecosystems, focusing on processes and patterns that are specific to the marine environment, beyond basic ecology concepts taught at undergraduate level. It provides the student with a general overview on the ecology and evolution of biodiversity of marine organisms throughout the tree of life. Students will learn the many unique and distinct components of marine biodiversity, their life histories and evolutionary context. The course will highlight the constraints that are particular to life in a marine environment, with their consequences in the pelagic/benthic oceanic domain and on the seashore. In marine population ecology students will train the applications and interpretation of concepts and tools to understand population variability in marine systems, persistence, dispersal and connectivity between populations. In marine community ecology students will study how relationships between species can regulate populations and shape communities, from pathogen/host to predator/prey, competitive and symbiotic interactions between different components of marine biodiversity. The study of processes mediating marine species interactions will comprise habitat engineering, resource-dependent effects, chemical interactions. The diversity of food web structures in the oceans and the challenges that are specific to marine systems will be presented and discussed. The students will be trained in how to measure biodiversity aiming to compare communities in various habitats, and they will be introduced into population dynamics.

Contents

I- MARINE BIODIVERSITY – EVOLUTIONARY ECOLOGY:

- Marine biodiversity: from DNA to the global Tree of Life. Evolution in the oceans: changing the chemical composition of the planet. Two domains of marine life:

Bacteria and Archaea and the eukaryotic diversification pathways from the combination of these.
- Temporal variability – from evolutionary to ecological time scales
- Spatial variability: geographical biodiversity variability and biodiversity hotspots
- Discussion of recent case-studies and applications in marine conservation and management.

II – MARINE POPULATION ECOLOGY

Population biology and life histories:
- Population variability in size and demography – consequences for population ecology
- Demographic consequences of marine life cycles, life histories, life cycles.
- Marine reproductive modes. Broadcast and spermcast mating, internal fertilizers and consequences for Allee effects.
- Clonal propagation versus sexual reproduction. Consequences for temporal stability, reproductive assurance and evolutionary potential.
- Inbreeding, outbreeding, fitness consequences. Optimal outcrossing distance. Local population adaptation.
- Intraspecific competition within and between populations, recruitment density barriers
- Discussion of recent case-studies and applications in marine conservation and management.

-Marine connectivity
-Dispersal scales in space. Causes and consequences of planktonic dispersive stages and directly developing marine propagules.
-Local versus supply-side recruitment and its implications for Marine Protected Areas.
-Marine metapopulations. Seascape genetics.
-Dispersal scales in time, arrested development and long-term persistent stages. Biological rhythms.
-Marine barriers to connectivity. Oceanographic factors, the ghost of history past, prior colonization effects.
-Population biogeography, processes behind the patterns.
-Dispersal of marine invasive species. Tracking sources and paths.
-Discussion of recent case-studies and applications in marine conservation and management.

III- MARINE COMMUNITY ECOLOGY

- Temporal dynamics of communities
- Facilitation, foundation species, habitat structuring species.
- Assemblage dynamics, species successions, seasonal variations.
- Community stability, resilience, resistance. Intermediate disturbance hypothesis.
- Spatial and temporal patterns in biodiversity and function of marine communities. Community biogeography, processes behind the patterns.
- Discussion of recent case-studies and applications in marine conservation and management.

Marine biotic interactions
- Symbiosis: mutualism, commensalism, amensalism, pathogens & parasistism. Marine examples, keystone effects (e.g., Symbiodinium, chemosynthesis), co-evolution.
- Interspecific competition. Drivers and consequences on pelagic versus benthic habitats.
- Herbivory and predation. Keystone roles in controlling dominance and competitive interactions marine ecosystems driven by species interactions.
- Marine chemical communication and defences mediating biotic interactions.
- Discussion of recent case-studies and applications in marine conservation and management.

- Marine food webs, energy and matter fluxes

- Primary Production
Photosynthesis: Light, Inorganic nutrients
Seasonal (temporal) trends in primary production
Chemosynthesis
Global distribution of primary production in the oceans
- Secondary Production and the Degradation of Organic Matter
Respiration
Herbivory and predation
Microbes and their role in marine systems: decomposition and recycling
Seasonal cycles of production and consumption and microbial loops
The supply of organic matter to deep sea heterotrophic systems
Specific Topics in Food Web ecology:
- diversity of food web structures in the marine ecosystems
- food web roles of microbes in the sea: Autotrophic, Heterotrophic and Mixotrophic microbes Importance of viruses
- Origin and transformation of Dissolved Organic Matter (microbial loop and pelagic trophic net)
- top-down and bottom-up effects
- trophic cascades
- Discussion of recent case-studies and applications in marine conservation and management.

Initial competences

Bachelor in sciences. Basic knowledge in biology. Students are assumed to have introductory level of general biology, principles of ecology, oceanography and general taxonomy of marine groups. Students must have an undergraduate level in general Ecology. Relevant concepts such as diversity and its measurement, food webs, community structure and the diverse population interactions (e.g. predator-prey) should be familiar to the student.
An undergraduate level in Marine Biology is also desirable: students should be familiar with the different types of marine habitats such as plankton, shallow benthos, intertidal zone, deep-sea benthos.

Final competences

1 This course will provide students with an understanding of the main questions, approaches and leading hypotheses in marine ecology that are specific to marine organisms, with their distinct variety of functional and taxonomic groups, life histories, colonization modes and functional interactions. Interpreting patterns and processes in marine ecology.
2 Students will acquire skills in designing and interpreting approaches to understand questions in the diversity of topics within marine ecology and their implications for marine biodiversity management and conservation.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture

Study material

Type: Handbook

Name: Marine Ecology: processes, systems, and impacts
Indicative price: € 55
Optional: yes
Language : English
Author : Michel J Kaiser & Martin Attrill, and co-authors
Number of Pages : 584
Additional information: Oxford university press

Type: Slides

Name: lecture slides
Indicative price: Free or paid by faculty
Optional: no
Available on Ufora : Yes
Available in the Library : No
Available through Student Association : No

Type: Excursion

Name: Sampling marine benthos along the Belgian coastline
Indicative price: € 15
Optional: no
Additional information: train ticket Gent - Ostend - Gent

References

Basic ecology books can be helpful as background support. However, the course focuses on advanced analysis of marine ecology research and is therefore based on research papers – these will be available as pdfs in the tutorial websites. The independent reading assignments for independent study will be chapters taken from the following books:

- Marine Ecology: processes, systems and impacts. Kaiser et al. (2011) Oxford University Press,2nd edition.
- Marine Community Ecology and Conservation: Bertness, Bruno, Sillmann & Stachowicz (2014) Sinauer Associates Inc.
- Mann, K.H. & J.R.N. Lazier. 2006. Dynamics of marine ecosystems. Biological-physical interactions in the oceans. 3rd ed. Blackwell
- Measuring Biological Diversity , Magurran, A.E. (2008) 2nd Edition Blackwell Science 256pp.

Course content-related study coaching

Assessment moments

end-of-term assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment, Assignment

Examination methods in case of periodic assessment during the second examination period

Written assessment, Assignment

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

1 written exam
2 presentation of personal work

Calculation of the examination mark