GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2025-2026

Quantitative Methods in Marine Science (C003872)

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	group work	0.0h
			seminar	
			lecture	

Lecturers in academic year 2025-2026

Braeckman, Ulrike	WE11	lecturer-in-charge
Vanaverbeke, Jan	WE11	co-lecturer
Vangestel, Carl	WE11	co-lecturer

Offered in the following programmes in 2025-2026	**crdts**	**offering**
International Master of Science in Marine Biological Resources	6	A

Teaching languages

English

Keywords

Position of the course

Numerical tools help to ask scientific questions more efficiently and extract appropriate answers. This course will introduce students to many basic techniques in data analysis and statistical modelling, to help them summarise a problem in mathematical terms, plan experiments or field sampling campaigns, and gather insights from the data collected.
Students will learn how to identify sources of variation in biological data and decide on sampling/experimental units and replicates. Major inferential statistical and data exploration techniques will be taught. A programming language (R) will be used to apply all those techniques.

Contents

The class will consist of theoretical parts and applications to actual data sets. The themes tackled are presented below. While the core of the programme will be the same in all universities, some classes are optional (in brackets: []) and the specific time spent on each part will vary between universities.
Maths and programming basics
Notion of variable and of assignation; data types; data import; data manipulation, repetition of operations.
*Numerical integration of differential equations; matrix computation
Data representation (visualisation)
Experimental/sampling design
Best practices in experiment and sampling design for optimal statistical power
Linear models
Revision of simple linear regression, revision of ANOVA (as a particular case of linear model)
Multiple regression and multi-factor ANOVA; model selection
[Introduction to generalised linear model: logistic regression, Poisson regression]
Introduction to mixed effects models

Non parametric tests
Notion of rank, basic non-parametric version of inferential tests (Wilcoxon-Mann-Whitney, Kruskall-Wallis)
*notion of bootstrap and bootstrap tests
Introduction to multivariate data analysis
Principal Component Analysis
Correspondence Analysis or Multidimensional Scaling
*Numerical modelling
*OD dynamical box and flux models (Fasham-like NPZD model)
*Population dynamics models (Leslie-like matrix models)

* Not at UGent

Initial competences

Bachelor in sciences. Basic knowledge in sampling and experimental design (notion of replicate), descriptive statistics (distributions, statistical moments), and basic statistical inference (comparison of means, correlation, one-way ANOVA, simple linear regression).

Final competences

1 Understand and identify sources of variation in biological data.
2 Decide on sampling/experimental units and replicates based on natural history, literature and identification of sources of variation in biological data.
3 Using the identified research questions, formulate the applying best hypotheses to test.
4 Identify traps in experimental designs.
5 Use the programming language R.
6 Apply data exploration techniques.
7 Construct major inferential statistical models.
8 Present the statistical output graphically.
9 Interpret the results of the statistical tests.
10 Collaborate on data analysis and interpretation.

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

Group work, Seminar, Lecture

Extra information on the teaching methods

lectures (h):
27
computerclass (h):
24
other (h):

University	lectures (h)	practicals (h)	seminars (h)	computer class (h)	field work (h)	other (h)
UGent	27	...	..	24	...	9
UAlg	...	...	...	60	...	...
UPMC	24	...	...	36	...	...
UniOvi	24	...	...	24	...	...

Study material

Type: Slides

Name: Course notes
Indicative price: Free or paid by faculty
Optional: no
Language : English
Available on Ufora : Yes
Online Available : No
Available in the Library : No
Available through Student Association : No

References

UPMC: Biostatistique (Scherrer), Numerical Ecology (Legendre & Legendre),
Uniovi: Sampling, 3rd Ed (S.K. Thompson),
Ugent: Experimental design and analysis for Biologists (Quinn & Keough (2002))

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

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

Written assessment

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

UALG: 3 h final exam, open notes with broad interpretation questions
UPMC: 3h written exam, no documents, exercises and interpretation questions
UGent: Group asignment (integrated exercise in R) + 3h written exam with exercises and interpretation questions. No documents allowed.
Uniovi: Assignment describing a complete sampling protocol/experimental design on a realistic scenario

Calculation of the examination mark

Final score is based on the group assignment (25%) and the written exam (75%).
All students are expected to contribute to the group assignment (verified through peer-evaluation).
The written exam consists of questions from two lecturers dealing with different parts of the course.
Students can only pass when they pass both parts of the written exam (75%).
If you do not show up at the designated time without a legitimate reason, you will be considered absent.