Course Specifications

Valid as from the academic year 2017-2018

Quantitative Methods in Marine Science (C003872)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

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

Credits 6.0 Study time 150 h Contact hrs 116.0 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	English	Gent	lecture	23.75 h
			seminar: practical PC room classes	35.0 h
			seminar	32.5 h

Lecturers in academic year 2020-2021

Vanreusel, Ann	WE11	lecturer-in-charge
Vanaverbeke, Jan	WE11	co-lecturer
Vangestel, Carl	WE11	co-lecturer

Offered in the following programmes in 2020-2021	crdts	offering
International Master of Science in Marine Biological Resources (main subject Applied Marine Ecology and Conservation)	6	A
International Master of Science in Marine Biological Resources (main subject Global Ocean Change)	6	A
International Master of Science in Marine Biological Resources (main subject Management of Living Marine Resources)	6	A
International Master of Science in Marine Biological Resources (main subject Marine Environment Health)	6	A
International Master of Science in Marine Biological Resources (main subject Marine Food Production)	6	A
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 numerical 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. Numerical models will be introduced as a way to simplify and formalise a system. A programming language (R) will be used to apply all those techniques.
Students will learn:

- how to use computer code to read and manipulate data, to implement statistical tests or dynamical models
- how to efficiently plan an experiment or field sampling campaign
- how to choose an appropriate data analysis technique
- how to interpret the output of basic inferential statistics
- how to represent data and model output graphically

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 (plotting)
Experimental/sampling design
best practices in experiment and sampling design for optimal statistical power
Linear model
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
0D dynamical box and flux models (Fasham-like NPZD model)
Population dynamics models (Leslie-like matrix models)

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

How to translate a marine sciences question or hypothesis in mathematical terms and how to select the factors that are more relevant to answer it.

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

Lecture, seminar, seminar: practical PC room classes

Extra information on the teaching methods

lectures (h):
24
computerclass (h):
36
other (h):
University lectures (h) practicals (h) seminars (h) computer class (h) field work (h) other (h) UGent 24 … .. 32 … … UAlg … … … 60 … … UPMC 24 … … 36 … … UniOvi 24 … … 24 … …

Learning materials and price

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

Evaluation methods

end-of-term evaluation

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

Written examination, oral examination

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

Written examination, oral examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

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: 3h written exam + oral feedback
Uniovi: Assignment describing a complete sampling protocol/experimental design on a realistic scenario

Calculation of the examination mark