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Faro, March 20^{th}, 2018

Topic: *Proposta de evento*

Name: *$R^{evolution}$ IX: descriptive statistics, hypothesis testing and quantitative ecology analysis in biological research*

Summary

Ecological research is becoming increasingly quantitative, yet students often opt out of courses in mathematics and statistics, unwittingly limiting their ability to carry out research in the future. This course provides a practical introduction to quantitative ecology for students and practitioners who have realised that they need this opportunity.

The course is addressed to people who were perhaps more confused than enlightened by their lectures in statistics and who have never used a computer for much more than word processing and data entry. From this starting point, it slowly but surely instils an understanding of mathematics, statistics and programming, sufficient for initiating research in ecology. The course's practical value is enhanced by extensive use of biological examples and the computer language R for graphics, programming and data analysis.

R is a language and environment for statistical computing and graphics (R-cran). R provides a wide variety of statistical (linear and non-linear modelling, classical statistical tests, time-series analysis, classification, clustering, ...) and graphical techniques. Many users think of R as a statistics system. Furthermore, it is an environment within which statistical techniques are implemented. R can be extended (easily) via packages, covering a very wide range of modern statistics and much more. It has become the lingua franca among statisticians, and is increasingly being used for data analysis among researchers. Many advanced or recent statistical and graphical/visualisation techniques are only available in R.

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1 Expected learning outcomes

This course does not intend to be a full introduction to statistics. The objective is to review the state-of-the-art statistical methods for analysis of ecological data, demonstrating the power of open source statistical software. We will provide hands-on experience for standard data analysis (cookbook), enabling participants to use the software on their own problems (take-home software).

The focus will be on giving the participants practical experience with R statistical software. The course material will be a blend of introductory lectures on R and practical sessions.

Participants will be introduced to the R environment and how to manage their R working space and data. Participants will learn how to write, comment and save scripts, how to prepare the results in a variety of formats that can easily be embedded in papers and presentations and how to prepare statistical reports into R. Participants will learn how to create standard statistical graphs such as bar plots, histograms, box-plots, scatter-plots and time series plots. They will also learn how to enhance these plots through the addition of titles, labels, legends, text annotations, colours and symbols. Next, participants will learn how to create multi-panel and 3D plots.

Finally, we will walk through quantitative ecology concepts and methodologies, including sampling design, data preparation, diversity analyses, basic ANOVA methods, hypothesis testing, diversity analysis and linear modelling.

2 Sessions

2.1 useR

Description: R session. Elements of the language.

2.2 gRaphics

Description: plotting functions and parameters.

2.3 autoR

Description: basic R programming and automatize tasks.

2.4 wRite

Description: preparing statistical reports using R.

2.5 Rspatial

Description: analysis of vector and raster cartography.

2.6 aRtistics

Description: experimental design, hypothesis contrast.

2.7 diveRsity

Description: diversity analysis, clustering.

2.8 multivaR

Description: multivariate analysis: ordination and gradient analyses, ENFA (Ecological Niche Factor Analysis), habitat suitability maps.

2.9 lineaR

Description: construction, optimization and evaluation of linear models. Representation and spatial interpretation.

2.10 modelaRt

Description: construction, optimization and evaluation of non-linear models. Representation and spatial interpretation.

3 Prerequisites

This course requires some prior experience in statistics and elemental mathematics. Knowing object-oriented programming is not needed.

4 Course format

This course is divided into 10 theoretical-practical sessions of 4 hours long, including assignments through which you can practice your mastery under supervision. Sessions will take place during the afternoon (14:00 - 18:00 h).

We will provide students with a selection of data sets with which to work, however participants are encouraged to bring their own data.

5 Inscriptions

Students:	250
Other participants:	350

6 Grants

We offer 4 grants for students. The grant will cover the half of the expenses for the course.

If you are interested, you should submit a short CV, a justification of your situation and a letter of motivation, explaining why and how do you think this course will improve you and your professional development, and how the grant will help you.

The decision won't be subjected to appeal.

7 Deadlines

Call for grants:	March - April 30^{th}
Resolution of grants:	April 30^{th}
Regitration:	April - May 3^{rd}
Start sessions:	May $7^{th} - 18^{th}$

8 About the Instructor

Fernando Cánovas is a postdoctoral fellow who belongs to the Marine Resources Management Team (maresma.org) at the Centre of Marine Sciences (CCMar). He is interested in solving questions about biology and evolution of species and populations by integrating genetic and quantitative ecology tools.

9 Frequently Asked Questions

- **What resources will I need for the classes?**
  A computer is needed on which the R software environment can be installed.

- **Is there a textbook for the class?**
  There is no required textbook for the class and all materials will be provided. There are, however, a few suggested readings.