





# INTERNATIONAL COURSE

# **Quantitative Marine Ecology**

**Time and Location:** 27-30 October & 3-6 November 2008, University of Vigo, Spain (Faculty building: Facultade de Ciencias, Campus de As Lagoas s/n, Vigo E-36310) (<u>http://www.uvigo.es</u>).

**Lecturers:** Profs. A. J. UNDERWOOD and M. G. CHAPMAN (Centre for Research in Ecological Impacts of Coastal Cities, University of Sydney, Australia).

#### General description:

The course covers the essential topics for the study on quantitative marine ecology and the fundamentals in the design and analysis of experiments in ecology, with emphasis on analysis of variance. The course will consist of lectures and practical PC exercises (8 days of lectures in total).

#### Contact address for information:

Dr CELIA OLABARRIA Departamento de Ecoloxía e Bioloxía Animal, Facultade de Ciencias, Campus de As Lagoas s/n, Vigo E-36310, Spain. Office: +34 986812589; Fax: +39 986812556 e-mail: colabarria@uvigo.es

Dr MÓNICA INCERA Centro Tecnológico del Mar-Fundación CETMAR, Rúa Eduardo Cabello s/n, E-36208 Vigo, Spain. Office: +34 986247047; Fax: +34 986294597 e-mail: mincera@cetmar.org

Dr JUAN MOREIRA Estación de Bioloxía Mariña da Graña, Universidade de Santiago de Compostela, Rúa de Ribeira 1, Ferrol E-15590, Spain. Office: +34 981333372; Fax: +34 981333373 e-mail: ebmgjuan@usc.es

**Audience:** The course will be limited to a maximum of 30 students and will target postgraduates, post-docs and researchers interested in developing skills in experimental design. No explicit pre-requisites are needed, but a general familiarity with univariate statistics and sampling techniques is expected. The course will be taught in English.

**Software:** The course fee will include GMAV 5.0.

**Inscription:** Registration fee is 900 € including lecture fee, course material and GMAV 5.0 fee. The deadline for pre-registration is 30 June, 2007. Filled pre-registration form must be sent to Dr. JUAN MOREIRA (ebmgjuan@usc.es). Selected participants will be communicated by the organizing committee to pay the inscription fee between July 1 and August 31 2007.

# DETAILED PROGRAMME:

### 1. Revisionary material

- Measurements, variables, populations, frequency distributions
- Parameters of location and dispersion
- Representative sampling; redefinition of the population when representation is not possible
- Biased sampling
- Statistical estimates of samples
- Operational definition of degrees of freedom
- Mensurative null hypotheses, one and two-tailed tests
- Tests using the normal and *t*-distributions (Confidence Limits)
- General procedures for a statistical test
- Types I and II errors
- Comparison of locations of two populations

## **Practical Exercises**

- Sampling frequency distributions
- Theorem of Central Tendency
- Relationship between sample size and estimates of means, variances and standard errors
- The *t*-distribution effect size, variance and sample size
- Random and stratified sampling

#### 2. Analysis of Variance for comparisons of locations of more than 2 populations

- Logical and probabilistic needs for a novel procedure
- Algebraic partitioning of variance
- A linear model for one-factor
- Assumptions of independence, homogeneity of variances and normality
- Effects of violations of assumptions
- Standard transformations of biological variables
- Power of a one-factor analysis
- Multiple comparisons: a priori and a posteriori

#### **Practical Exercises**

• Analyses of one-factor sets of data, involving tests of homogeneity of variances, transformations and multiple comparisons

#### 3. Nested Analysis of Variance

- Confounding ("Pseudoreplication")
- Models for nested design
- Post hoc pooling
- Cost-benefit analysis and sampling design

#### **Practical Exercises**

• Nested analyses and their interpretation

#### 4. Factorial Analyses of Variance

- Orthogonal designs
- Efficiency and information content
- Interpretation of interactions
- Fixed and random factors
- Multiple comparisons

#### **Practical Exercises**

- Factorial analyses with fixed and random factors and their interpretation
- Multiple comparisons

#### 5. General Models: Experimental Design

- Typical biological experiments
- The General Linear Model
- Rules for Mean Square Estimates
- Interpretations, *post hoc* pooling
- Calculations of Sums of Squares
- Multiple comparisons

#### **Practical Exercises**

- Mixed and nested orthogonal models and their interpretation
- Rules for constructing Mean Square Estimates
- Calculations of sums of squares from fully orthogonal designs

#### 6. Correlations and Regressions

- Differences between regression and correlation
- Linear correlation
- Rank correlation
- Linear Least-squares regression
- Partial linear regressions
- One-Factor Analysis of Covariance (a sequence of 3 linear models)

#### **Practical Exercises**

- Linear correlation
- Linear regression
- One factor Analysis of Covariance