

Biodiversity & Ecology 212 (BDE 212)

Skills for Biologists

16 credits, first semester

2022

Course Coordinator: Prof. Susana Clusella-Trullas; sct333@sun.ac.za; Room 3071, Natural Sciences Building (*email first to make appointments*).

Technical Assistant: Shula Johnson- Abrahams shulaj@sun.ac.za (808-3231, Room 2018), Natural Sciences Building.

Lecturers:

Prof. Susana Clusella-Trullas (SCT) Room 3071

Prof. Michael Cherry (MC) Room 2037

Prof. Conrad Matthee (CM) Room 2031

Dr Anandi Bierman (AB)

Demis:

Gaylen Carelse (gaylen@sun.ac.za)

Gerhard Wiese (tba)

Amore Malan (amoremalan@gmail.com) for AMOVA prac

Aims:

This course aims to introduce you to the nature of science, and how science is done by properly designing a study and analysing your data. It also gives you generic skills in data presentation and writing that you can apply as undergraduates and as postgraduates in your chosen direction.

Doing Science: on completion of this component of the course, you should understand the following about the practise of science, and be able to apply it to biology:

- » Searching the literature
- » The publication process
- » Ethics of publication and research
- » The interface between science and the public through popular science
- » Use of Microsoft PowerPoint for data presentation for both written presentations and verbal seminars;
- » Experimental design, replication, pseudoreplication

Data Analyses: this large section includes the exploration of the scientific method and hypothesis testing, parametric and non-parametric statistics, comparisons between two or more groups of values using analysis of variance-based techniques, and correlation and regression. By the end of the module, you

should be able to do the following with your own data sets, *in addition to understanding how the analyses work, and being able to report them*:

- » identify different data types;
- » set up null and alternative hypotheses;
- » use Microsoft Excel for data handling and presentation;
- » organize data frames for statistical analyses;
- » exploration of original data (tables and plots): e.g. histograms, density plots, scatter plots, boxplots;
- » use of R free software: the R Project for Statistical Computing (<https://www.r-project.org>) for statistical analyses;
- » describe data statistically using means, medians, standard deviations, and ranges;
- » assess whether or not data are normally distributed;
- » choose and perform the appropriate statistical tests to:
 - compare a single variable between two, three or more groups using *t*-tests and ANOVAs or their non-parametric equivalents,
 - relate two variables to one another using correlation and linear regression;
 - perform analyses of covariance (ANCOVAs) where appropriate;
- » perform power analyses to choose sample sizes, and assess effect sizes;
- » relate the results of statistical analyses back to original research hypotheses or questions; and,
- » combine all of these skills to write a scientific report in the format of a manuscript for submission to a scientific journal, with appropriate reporting of analysed data and statistics.

Textbook: The statistical component of the course is based on

McKillup, S. (2012) *Statistics Explained: an Introductory Guide for Life Scientists* (2nd Edition). Cambridge University Press, Cambridge, UK.

Additional material will be made available on SunLearn.

See Language implementation for this course at the end of study guide

Lecture programme: The course comprises 39 lectures, three per week, on Mondays (12h00-12h50), Wednesdays (08h00-08h50) and Fridays (09h00-09h50). Lectures will be in the Annex (Rm 1030), Natural Sciences building. Please strictly adhere to all relevant SU Covid-19 regulations and protocols at all times when attending lectures and practicals.

Lect #	Date	Topic	Lecturer
39 lectures			
1	14/02	Introduction to the course; lecturers	SCT
2	16/02	The scientific method; Descriptive versus inferential statistics	SCT
3	18/02	Defining a research question; and designing a research study	MC
4	21/02	Basic descriptive statistics; How to report statistics & Plotting	SCT
5	23/02	Recap lecture if needed /prac revision	SCT
6	25/02	Writing research articles and proposals. Ethical clearance, permits, collaborations	MC
7	28/02	Normal distribution and null hypothesis testing	SCT
8	02/03	Prac revisions & Experimental design (power)	SCT
9	04/03	Scientific referencing and how to cite others' work	MC
10	07/03	Comparing two population means: two samples <i>t</i> -test	SCT
11	09/03	Experimental design principles & Revisions prac /	SCT
12	11/03	The publication process: journal impact factors, metrics, peer review, open access	MC
13	14/03	Comparing two means: non-parametric test :	SCT
14	16/03	Prac revisions	SCT

15	18/03	self-study for test/online questions	SCT
16	21/03	Public Holiday	

17	23/03	Analysis of variance ANOVA	SCT
18	25/03	Follow Monday timetable No class	SCT
28 March – 1 April: Recess			
19	04/04	Correlation	SCT
20	06/04	Prac revision – ANOVA	SCT
21	08/04	Linear regression	SCT
22	11/04	ANCOVA	SCT
23	13/04	prac revision correlation	SCT
24	15/04	Public Holiday	
25	18/04	Public Holiday	
26	20/04	AMOVA	CM
27	22/04	AMOVA	CM
28	25/04	AMOVA	CM
29	27/04	Public Holiday	
30	29/04	AMOVA	CM
31	02/05	Public Holiday	
32	04/05	Data collection	AB
33	06/05	Record keeping, data entry	AB
34	09/05	Data presentation tool kit (tables & figures)	AB
35	11/05	Data presentations: (verbal & poster)	AB
36	13/05	Popular science reporting and media interactions	AB
37	16/05	Revisions for exam / online questions	SCT & CM
38	18/05	Self-study revision /online questions	
39	20/05		

- 1 written exam (partly using computers, partly in answer books) (40% exam mark)

Practical programme: There are 12 three-hour practical/tutorial sessions, one per week for each student, Tuesdays, 10:00 – 13:00 (venues: Narga G and H). Microsoft Excel and PowerPoint will be used in these tutorials, and we assume a basic knowledge of these programmes. We will introduce you to R Project for Statistical Computing free software and give you extensive opportunities to practise with this programme.

The exam and test will assess both the implementation and understanding of knowledge covered in this module. The reports, presentations, and tutorial discussions will test your ability to communicate and express ideas in written and oral form, the two main modes of communication for scientists. Lecturers' comments on your reports will refine your writing and thinking skills.

Mark calculation:

Your *Final mark* is the sum of your *Class mark* and *Exam mark*:

Class mark composed of:
 Prac exercises.....20%
 Oral presentation..... 10%
 Report AMOVA 10%
 Class test 20%

Class mark: 60%
Exam mark: June exam..... 40%
 = *Final mark* 100%

To qualify for the examination, you are required to obtain a subminimum 40% for the *Class mark*. You are required to obtain an *Exam mark* of at least 40% to be allocated a *Final mark* of 50% or higher. In order to pass the module, you need to achieve a *Final Mark* of at least 50%. For other University rules governing allocation of marks, see p 225 (University Examinations) in the 2018 General US Yearbook.

Test, assignment and examination dates:
*Semester test**: 22 March 2022; *prac venue Assignment/Report (AMOVA)*: tba.

*Examination**: 24 May 2022; 14h00
*Exam 2nd opportunity**: 14 June 2022; 14h00
 *: Semester test and exams held in NARGA, exact venues on SunLearn and in class.

Prac #	Date	Topic	Lecturer
1	15/02	Introduction to R, data handling	SCT
2	22/02	More data handling in R, basic statistics	SCT
3	01/03	Normality test and confidence limits	SCT
4	08/03	Power test and two sample test	SCT
5	15/03	Paired designs and non-parametric two sample test	SCT
6	22/03	Semester test	SCT
28 March – 1 April: Recess			
7	05/04	Analysis of variance	SCT
8	12/04	Correlations	SCT
9	19/04	Follow Monday timetable Linear regression and analysis of covariance (home task)	SCT
10	26/04	AMOVA prac	CM
11	03/05		
12	10/05	Student presentations (posters)	CM
13	17/05		

Assessment: By examination.

- Participation and completion of practical exercises/quizzes or pracs in full (20% class mark) (SCT)
- Report AMOVA (10% class mark) (CM)
- Skills: Presentation/Poster (10% class mark) (CM)
- 1 class test (partly using computers, partly in answer books) (20% class mark)

Important information:

When you miss a test or deadline, you must hand in a valid original medical certificate to M. de Jager **within one week of the test or hand-in date**. In special circumstances (e.g. participation in provincial or national sporting events) a letter is required from the sporting body. **In these instances, granting of permission to miss tests or deadlines is at the discretion of the course co-ordinator, and is not automatic.** It is your own responsibility to make sure that you know the time and place of each test and exam.

Reports handed in late will have marks deducted at a rate of 5% per day. Reports handed in a week or more after the deadline will not be marked. If a practical is missed for medical reasons, the student needs to complete the practical on his/her own time and valid original medical certificate presented within 2 days from absence.

Language implementation for this course

The Department of Botany and Zoology recognises English as the international academic language and a medium through which science can be communicated with each other. It is thus our endeavour to ensure that each and every one of our students are proficient to communicate through the medium of English. We will however accommodate our Afrikaans students to the best of our ability.

The following language option will be implemented in this BDE module: Lectures will be offered in **English only**

Language of materials

The materials for learning will be made available as follows:

- (i) All compulsory reading material will be provided in English. Compulsory reading material (excluding published material) will also be provided in Afrikaans unless it is not reasonably practicable to do so.
- (ii) Module frameworks/study guides available in English and Afrikaans upon request.
- (iii) Question papers for tests, examinations and other summative assessments will be available in Afrikaans and English. Students may answer all assessments and submit all written work in either Afrikaans or English.