

Data & Analysis in Natural Sciences

[Data Analysis Nat Sci]

TENTATIVE COURSE INFO

3 credits

FALL 2015

GLY6932/GLY4930 || ZOO6927/ZOO4926

Instructor: Michal Kowalewski (kowalewski@ufl.edu), Dickinson 254 (Tel: 352-273-1944)

Lectures: MAT 0108, MWF (3), 9:35am-10:25am

Labs: MAT 0014, W (6-7), 12:50am-2:45pm

Prerequisites for Graduate Students: None

Prerequisites for Undergraduate Students: Consent of the instructor

Textbook Required: None (Readings will be assigned and provided in class)

Freeware: R

Hardware: Laptop is required for lab meetings

Synopsis: This course will combine lectures and hands-on lab activities with focus on practical applications of classic statistical methods in natural sciences. Examples will primarily derive from ecology, paleobiology, and geological sciences. Lab sessions will provide practical training in using R for data processing and analyses. The course will consist of self-contained modules built around empirical examples. Although some of the topics are inherently biological, many aspects of the course should be transferable to other disciplines of natural sciences. This course will provide intuitive (rather than mathematical) introduction to common methods used in natural sciences to analyze empirical and experimental data. The course will NOT cover phylogenetic methods.

Topical Overview

Segment	Content
S1: Introductory Materials	Data, variables, data reporting, data transformations and standardization, univariate descriptors, hypothesis testing
S2: Interactions between Two Variables	Bivariate plots, covariance, correlation, and regression
S3: Ordinations: Exploring multivariate data in natural sciences	Exploratory methods: PCA, PCO, nMDS, CA, DCA, CCA, CVA Confirmatory methods: MANOVA, MANCOVA, Permutation tests, Classificatory methods, Discriminant functions
S4: Measuring diversity	Diversity indices, RAD models, alpha-beta-gamma, sampling standardization methods (rarefaction, Jackknife, shareholder quorum, etc.), preview of disparity
S5: Resampling strategies in natural sciences	Randomization, bootstrap, jackknife, subsampling, Monte Carlo models
S6: Additional Topics*	Examples: Size and shape (body size, allometry, heterochrony) Morphometrics and morphological diversity. Time series and autocorrelation, correcting for multiple tests, angular and other non-ratio variables, scaling phenomena (evolutionary rates, net sedimentation rates)

*Additional topics to be covered (time permitting)

Tentative Schedule

NOTE: You may have already noted that 3 lecture meetings + lab meeting are scheduled weekly, which is more consistent with 4-credit rather than 3-credit course. However, Friday meetings will be scheduled on few occasions only to compensate for class cancellations in certain weeks. The scheduled Friday lectures are indicated below.

Schedule

Week 01: 08/24 MW	(W —no Labs)	
Week 02: 08/31 MWF	(W —no Labs)	
Week 03: 09/07 M WF	(W - Lab 1)	(No Monday Lecture – Holiday)
Week 04: 09/14 MW	(W - Lab 2)	
Week 05: 09/21 MW	(W - Lab 3)	
Week 06: 09/26 MW	(W - Lab 4)	
Week 07: 10/05 MW	(W – Lab 5)	
Week 08: 10/12 MW	(W - Lab 6)	
Week 09: 10/19 MWF	(W - Lab 7)	
Week 10: 10/26 MWF	(W - Lab 8)	
Week 11: 11/02 MW	(W —no Labs)	(No Labs or Lectures; MK at a conference)
Week 12: 11/09 MW	(W —no Labs)	(No Labs or Lectures; holiday)
Week 13: 11/16 MWF	(W - Lab 9)	
Week 14: 11/23 MW	(W —no Labs)	(Thanksgiving Holiday, no W lecture, no W labs)
Week 15: 11/30 MW	(W – Lab 10)	
Week 16: 12/07 MW	(W —no Labs)	

F – Scheduled Friday lectures

F* – Tentative slots reserved for additional Friday lectures (if needed)

Lecture Topics

- Scientific Methods
- Type of Research in Natural Sciences
- Types of Data
- Hypothesis Testing
- Univariate Tests (Part 1)
- Univariate Tests (Part 2)
- Bivariate Methods
- Multivariate Ordinations (Part 1)
- Multivariate Ordinations (Part 2)
- Multivariate Ordinations (Part 3)
- Multivariate Ordinations (Part 4)
- Multivariate Tests (Part 4)
- Resampling Methods
- Diversity (Part 1)
- Diversity (Part 2)
- Scaling and Time Series

Labs

Tutorials and exercises in R, Assignments 1-8