Data & Analysis in Natural Sciences

[Data Analysis Nat Sci]

TENTATIVE COURSE INFO

3 credits

FALL 2014
GLY6932/GLY4930 || ZOO6927/ZOO4926

Instructor: Michal Kowalewski (kowalewski@ufl.edu), Dickinson 254 (Tel: 352-273-1944)
Lectures: Williamson 210, MWF (3), 9:35am-10:25am
Labs: Williamson 210, 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 graduate-level course will combine lectures and hand-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 up to seven 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
S5: Morphometrics: Describing form of objects*	Size and shape (body size, allometry, heterochrony) Classic multivariate approaches, outline methods, landmark-based methods, disparity (morphological diversity)
S7: Special cases common in natural sciences*	Examples: 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 (if there is enough time for it)