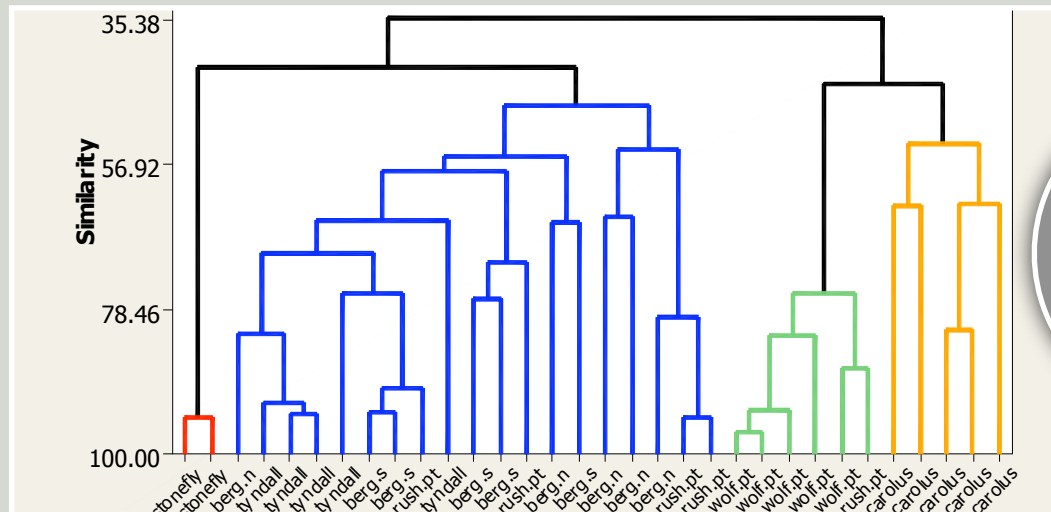


= Practical Stats

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NMDS,
Dendrograms
and Biplots

are 3 of the many useful
methods for visualizing
multidimensional data

Untangling Multivariate Relationships

Turn confusion into recognizable patterns

Environmental measurements often are simultaneously recorded as a series of variables or species. Multiple chemicals are analyzed. Multiple measures of ecosystem health are recorded. If statistics are computed on each, one by one, the interrelations among variables, species and locations cannot be seen. Valuable information is lost. Multivariate methods resolve what at first may look like noise into recognizable patterns, providing new insight into the field of study. However, these methods are daunting to many scientists, with acronyms like PCA, CCA or CANOCO, and with unfamiliar terms like varimax rotation and detrended

correspondence. The learning curve seems steep, and useful procedures go unused. UMR covers the multivariate methods of primary interest to environmental science, focusing on what each method is designed to do, when to use them, and when not to. Methods for simplifying data are contrasted with those for establishing connections between and among source and response variables. Capabilities of various software packages are reviewed. Example data sets are analyzed by each student in class. By the end, the choice of which method to use, and how to use it, simply makes sense.



One on One Instruction

Class sizes are kept small enough that instructors are able to work with students during exercises, enabling them to make sense of their data.

Untangling Multivariate Relationships

Course Outline

DAY 1

Intro to Multivariate Methods

- goals and objectives of each
- classification vs inter-dependence
- availability of software

Graphing Multivariate Data

- visualizing patterns in 3+ dimensions
- Biplots, Score plots
- Matrix and draftsman plots
- Graphs with parallel and polar coordinates
- Nonmetric multidimensional scaling (NMDS)

Principal Component Analysis

- what PCA accomplishes
- how PCA is computed
- Interpreting scores and loadings
- Exercise: PCA for differentiating species patterns

Factor Analysis

- what FA can and cannot accomplish
- differences between FA and PCA
- how many factors?
- Exercise: Factor Analysis on species patterns

Correspondence Analysis

- CA objectives
- relation to contingency table tests
- plot of associations
- Detrended CA
- Exercise: CA on microcrustaceans

DAY 2

Cluster Analysis

- Methods of clustering. Linkages
- How well can known clusters be identified?
- Determining the number of clusters
- Interpreting dendograms
- Exercise: Clustering sites by chemical and species patterns

Discriminant Analysis & Logistic Regression

- Classifying observations into groups
- Assumptions and method mechanics
- Availability of software
- Parametric (DFA) vs nonparametric (LR) methods
- Exercise: DFA & Logistic on air quality data

Canonical Correlation and Canonical Correspondence Analysis

- Correlations between sets of variables
- What can and cannot be accomplished
- Tests for significant correlations
- CanCorr between species and site characteristics

Nonparametric Methods

- Nonmetric multidimensional scaling
- Nonparametric MANOVA to differentiate groups
- Multivariate trends
- Determining which variables contribute most to group differences