Practical Stats Newsletter for Aug 2011

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1. Upcoming courses

Untangling Multivariate Relationships
Turn confusion into recognizable patterns
Sept 21-22, 2011 $795 registration
USGS Water Science Center $650 if registered for the AHS Symposium
2255 N. Gemini Dr.
Flagstaff, AZ 86001
NEW: Includes how to incorporate nondetects into multivariate procedures.

Applied Environmental Statistics
Statistics, down to earth
Dec. 5-9, 2011 $1495 registration
Homewood Suites $1395 before Nov. 19, 2011
7630 Shaffer Parkway $1295/person for 2 or more registrations
Littleton, CO 80127

You can always find our complete course listing on our "Upcoming Classes" page at
http://www.practicalstats.com/new_classes/classes.html

Also: Upcoming workshops by Dr. Dennis Helsel.
Making Sense of Nondetects
Arizona Hydrological Society's Annual Symposium, Sept 20, 2011 in Flagstaff, AZ.
Symposium registration is NOT required. $50 registration. See
http://www.azhydrosoc.org/workshops.html

It Ain't Necessarily So: Urban Legends in Environmental Statistics
USEPA Quality Symposium, October 26, 2011, in Cincinnati, OH.

2. The Mantel Test: Multivariate Trend Tests for Data with Nondetects

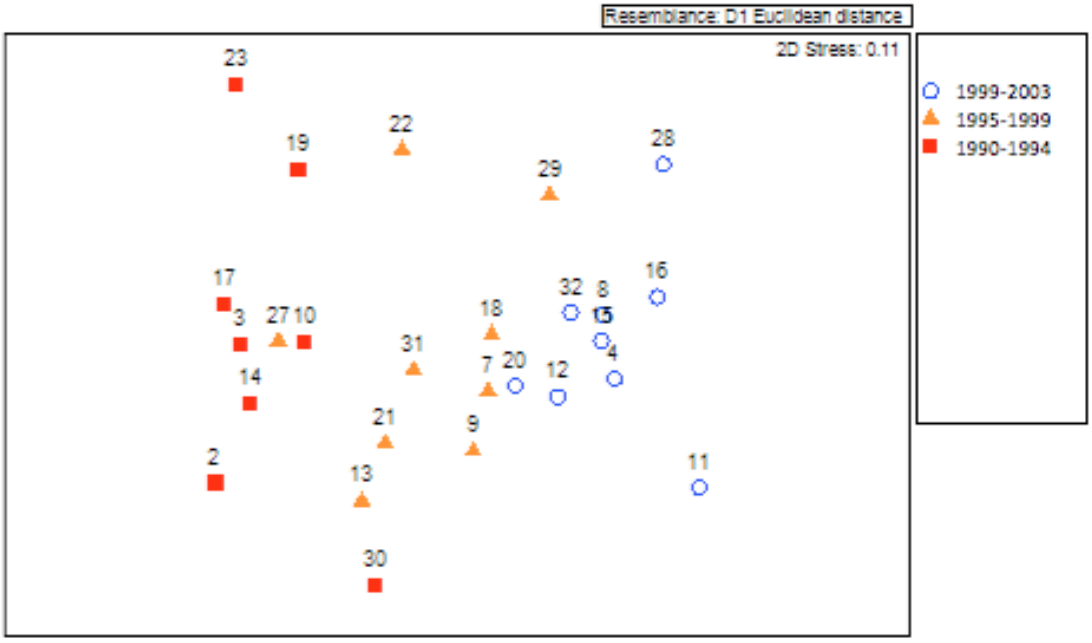
How would you compute a multivariate trend test analogous to the Mann-Kendall test for trend, but using the pattern of multiple chemical or biological parameters in total? And throw in an ample percentage of nondetects as well.

Mantel tests are a class of procedures that do just this, and more, with style. These tests compute a triangular matrix of distances (say between observations) based on the multivariate suite of parameters. Then they compute a second triangular matrix of the same size for the distances in time between measurements. In the final step, a correlation coefficient is computed between each corresponding element in the two matrices. If significant, the correlation signifies a trend, a significant change in the multivariate chemical/biological pattern over time.

Mantel tests got a bad reputation several decades ago when proponents were using the standard parametric correlation coefficient Pearson's r to measure correlation between the two matrices. Assumptions of normality in the relationship between the two matrices were hard to justify. Their use was rejuvenated with the adoption of nonparametric coefficients Spearman's rho and Kendall's tau, and with the advent of permutation methods for determining p-values rather than relying on large-sample approximations. With these changes, no assumptions concerning the distribution of the data elements need be made. The software package Primer (www.primer-e.com) adopted Mantel tests for trend and group differences of multivariate ecological data, naming them the "test for seriation" and "ANOSIM", respectively. Both are simply nonparametric versions of the Mantel test.

In our upcoming Untangling Multivariate Relationships course we'll look at six DDT metabolites in fish, and whether there is a change in the pattern of those compounds over time – a trend. Several values are listed as <RL, where RL is the reporting limit. First the ranks of concentration are computed within each metabolite. A <5 is easily ranked as lower than a detected 8, for example. Second, a resemblance matrix between the samples is computed using Euclidean distances between ranks. The Euclidean distance combines the distances between ranks for each compound into one overall measure of distance between samples. The question then becomes whether these overall distances systematically change with increasing time. If so, the pattern of metabolites changes with time – the mix of compounds exhibits a trend. Third, a matrix of differences in sample times (or perhaps their ranks) is similarly computed. Kendall's tau correlation coefficient between corresponding elements of the resemblance matrix of compounds and the matrix of sampling times is tested against a random pattern generated from thousand of permutations of the time order of samples. The one observed correlation coefficient of tau=0.49 is large compared to the collection of permuted values where time has no relationship to the resemblance matrix. The resulting p-value of 0.001 indicates that the 0.49 correlation is not like the permuted results due only to chance. There is a trend in the pattern of metabolites over time. All this was accomplished without substituting any numbers for the censored data. Instead, data are simply ranked.

A nonmetric multidimensional scale plot of the data tagged with a different symbol for three time segments clearly shows the trend.



taken from *Statistical Methods for Censored Environmental Data* (Helsel, 2012)

Data change from left to right across the plot as time progresses.

For much more on these tests, attend the Untangling Multivariate Relationships course in September in Flagstaff, or wait and purchase the new textbook *Statistical Methods for Censored Environmental Data* in January 2012. The new book is the second edition of *Nondetects And Data Analysis* by Dennis Helsel that was published in 2005. Use of Mantel tests is one of the new sections in the second edition.

3. Practical Stats Consulting -- Florida water quality

Water quality is big news in south Florida. Practical Stats was recently commended in a news release from Minitab Statistical Software after providing training and assistance to a Florida International University team who classified and prioritized water quality issues at 350 south Florida monitoring stations. The team required help in dealing with many nondetect values, and to evaluate and use multivariate procedures in the classification and prioritization. As a result, ..."Dr. Briceño, who is not a statistician by trade, easily used Dr. Helsel's macros and Minitab to calculate the statistics necessary to analyze water quality at each monitoring station." The macros they used are available to you on the Nondetects section of our website,
http://practicalstats.com/nada/
The multivariate course is again being held in September (see above). Personalized consulting help is always available from Practical Stats, where we focus on scientists who are not "statisticians by trade" but by necessity. Contact us for our consulting help at ask@practicalstats.com .

To read the full story, go to
http://www.minitab.com/uploadedFiles/Company/News/Case_Studies/FIU_EN.pdf

'Til next time,

Practical Stats (Dennis Helsel)
-- Make sense of your data