

Practical Stats Newsletter for April 2020

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A. Practical Stats Courses

On our online training site: <https://practicalstats.teachable.com/>

Our Nondetects And Data Analysis (NADA) course is available online. It's a complete coverage of data analysis with nondetects and 'remarked data': summary statistics, regression, group testing, and even some multivariate methods, all without substituting fabricated numbers like $\frac{1}{2}$ the detection limit. One year's access to the materials costs \$695. The R scripts included provide new functionality to make data analysis easier, and are a step forward from the NADA package in R.

Our Applied Environmental Statistics courses cover methods from simple statistics through trend analysis. They are also an introduction to using R software, the most widely used statistics software in the world. They are available in two parts, each \$650 USD for a 1-year access for one person. Or get both courses together in a bundle for \$1200 USD. See our online training site at the link above.

B. What methods are in the online NADA course?

There are many scripts for R that come with our Nondetects And Data Analysis course. They make it much easier to perform data analysis for censored data. All methods completely avoid any substitution of values for nondetects. All methods work with multiple detection limits. Some of the methods included are:

Graphics and Descriptive Statistics

- Boxplots for censored data. Has several advantages over the `cenboxplot` command in the NADA package, including the ability to plot multiple detection limits when groups being plotted differ in those limits.
- The equivalent number of observations for censored data. Indicates the amount of information that is available in data with nondetects. Censored values with lower detection limits have a greater proportion of the information contained in a detected observation. You may be surprised with how little information you lose with censored data.
- Fitting distributions to the cumulative distribution function (cdf) of censored data, with the BIC statistic to determine which distribution is the best fit.
- Probability (Q-Q) plots for censored data with the Shapiro-Francia statistic to determine whether data fit that distribution.

- Prediction, confidence and tolerance intervals for censored data assuming normal, lognormal and gamma distributions.

Hypothesis Tests

- A parametric test for difference in the means of two groups (a “censored t-test”).
- A parametric test for whether the mean difference in paired data differs from zero (a “censored paired t-test”). May also be used to test whether one column of censored data exceeds a standard.
- A parametric test for difference in group means (a censored "analysis of variance") followed by its multiple comparison test.
- The nonparametric signed-rank test for paired censored data.
- The nonparametric sign test for paired censored data.
- The nonparametric PPW (Paired Prentice Wilcoxon) test for paired censored data.
- The Peto-Peto nonparametric test of group differences (a censored Kruskal-Wallis test) followed by multiple comparison tests.

Regression and Correlation

- Three correlation coefficients for censored data.
- Regression for censored data, with Q-Q plots of residuals to evaluate fit.
- Multiple regression for censored data with AIC and BIC to evaluate which variables to include to get the ‘best’ regression model.

Trend Analysis

- The nonparametric ATS test and line. Performs the Mann-Kendall test for censored data, computes the Akritas-Theil-Sen line and draws a scatterplot with the line. If the Y data are in log units, the scatterplot has the option to retransform back to original units and show the fitted curve.
- Mann-Kendall (ATS) test for trend on residuals from the relationship of Y to a covariate other than time.
- The Seasonal Kendall test for trend with censored data.

Multivariate Methods

- Computation of similarity and dissimilarity coefficients for censored data.
- Nonmetric multidimensional scale plots for data with nondetects.
- Cluster analysis of data with nondetects.
- The ANOSIM test of group differences for multivariate censored variables (a multivariate Kruskal-Wallis test for data with nondetects).

The video lectures describe how each of these methods works and how to implement them in R.

C. Our on-demand April 'webinar'

Matched Pair Tests for Data With Nondetects

a Practical Stats webinar

Tuesday April 21, 2020 at any time you wish.

Paired differences such as concentrations Before vs. After treatment at a series of sites or Upstream vs. Downstream of an outfall at several points in time are usually analyzed for change with a paired t-test (parametric) or signed-rank test (nonparametric). But what methods can be used when data include values below detection or quantitation limits? This video will present several methods that are available and demonstrate their use with R software.

If you haven't already you can register at any time to access our Training Site, <https://practicalstats.teachable.com> . There is no charge to register, and the April video ('webinar') is free to view.

'Til next time,

Dennis Helsel

Practical Stats LLC

-- Make sense of your data