

Computer Exercise: Week 4 **Zoology 535, Ecosystem Analysis**

In this exercise we will compare two approaches to prediction using the same data set. The data are from whole-lake experiments in which nutrient input and food web structure were manipulated (Carpenter et al. 2001). The model we will consider is

$$\text{ChlAR} = b_0 + b_P \cdot \text{Pload} + b_Z \cdot \text{zlen} + \text{error}$$

where ChlAR is chlorophyll density (mg m^{-2}), Pload is phosphorus input rate ($\text{mg m}^{-2} \text{d}^{-1}$), zlen is mean length of crustacean zooplankton (mm), and b_0 , b_P , b_Z are parameters to be estimated from the data. The distribution of ChlAR is skewed and can be approximated by a lognormal distribution. See the original paper for more details.

The program ShowData.R plots the data and displays a correlation matrix.

The program LakeChl0.R fits the model in R and predicts ChlAR for Pload=2, zlen=0.9. Note the correction for lognormality in the calculation of the predicted mean.

The program LakeChl0.odc samples from the posterior distribution of the parameters using WinBugs and computes the predicted distribution of ChlAR for Pload=2, zlen=0.9.

Compare the estimates of b_0 , b_P , b_Z , tau (1 / residual variance) and predicted ChlAR for the two analyses. Are they different, and if so how? What are the advantages and disadvantages of the two analyses and predictions?

Reference

Carpenter, S.R., J.J. Cole, J.R. Hodgson, J.F. Kitchell, M.L. Pace, D. Bade, K.L. Cottingham, T.E. Essington, J.N. Houser and D.E. Schindler. 2001. Trophic cascades, nutrients and lake productivity: whole-lake experiments. *Ecological Monographs* 71: 163-186.