Ecology, 89(5), 2008, p. 1473

A STATISTICAL TEST TO SHOW NEGLIGIBLE TREND: REPLY

Philip M. Dixon[1,3] and Joseph H. K. Pechmann[2]

Camp et al. (2008) extend the ideas discussed in Dixon and Pechmann (2005). Our paper used equivalence regions to test for negligible trends (null hypothesis that trends are not negligible). Their paper suggests also using equivalence regions to test an alternative hypothesis of "ecologically meaningful" trends (null hypothesis that trends are negligible but not zero).

Camp et al. are appropriately concerned by our choice of words to interpret one possible outcome of a combination of an equivalence test and a traditional test of no trend. Our wording for region B in their Fig. 1 is inconsistent with the themes emphasized in the rest of our paper. Their suggested wording is appropriate. However, since 2005, we have come to favor more specific interpretations such as, "a trend that is statistically different from zero, but not estimated well enough to conclude that it is less than −0.035." Such an interpretation avoids phrases like "ecologically meaningful" that may be misleading if taken out of context.

The Bayesian interpretation is very reasonable, especially when it leads to calculations of probabilities that the trend is small ($\beta < \varphi_l$), negligible ($\varphi_l < \beta < \varphi_u$), or large ($\beta > \varphi_u$), where β is the slope of the trend and φ_l and φ_u are lower and upper slope intervals within which a trend is considered ecologically negligible.

However, readers using this approach for small data sets, like the Laysan Duck example, should be aware of the influence of the choice of prior distribution on the results. Camp et al. label their prior distributions as uninformative. They are not. If the prior distributions are uninformative, the posterior distribution is proportional to the likelihood and frequentist confidence intervals are numerically the same as the Bayesian credible intervals. For the Laysan Duck data in Table 1 of Camp et al. (2008), the credible interval for the trend is about 18% longer than the confidence interval. The problem is the choice of prior distribution for τ, the precision (=1/variance) of observations around the regression line. We advise either using more diffuse proper priors or deliberately choosing an informative prior that can be justified by biological knowledge or previous data. Examples of diffuse proper priors that might be considered are a uniform distribution with a large range, e.g., Unif(0,10000), or a Gamma (0.001,0.001) distribution that has a larger variance than the prior distribution used by Camp et al. It is also good Bayesian statistical practice to evaluate the sensitivity of conclusions to the choice of prior. This evaluation is especially important when the sample size is small or the data are highly variable, because then the data do not necessarily overwhelm the prior.

We join with Camp et al. in encouraging ecologists to ask more interesting questions than "Does the trend = 0?"

Manuscript received 9 November 2007; accepted 18 December 2007. Corresponding Editor: K. L. Cottingham.

[1] Department of Statistics, Iowa State University, Ames, Iowa 50011-1210 USA.
[2] Department of Biology, Western Carolina University, Cullowhee, North Carolina 28723 USA.
[3] E-mail: pdixon@iastate.edu

Literature Cited

Camp, R. J., N. E. Seavy, P. M. Gorresen, and M. H. Reynolds. 2008. A statistical test to show negligible trend: comment. Ecology 89:1469–1472.
Dixon, P. M., and J. H. K. Pechmann. 2005. A statistical test to show negligible trend. Ecology 86:1751–1756.