The distribution of the expected numbers of individuals of detectable species as a way of describing species abundance

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Abstract:

A different and complementary statistical approach from those previously considered in literature is presented here to describe species abundance data. The data consist of the counts of individuals of each of M different species observed in a random sample taken within a region of interest, where M is also random.

The counts of individuals for a given species are assumed to follow a Poisson distribution and to be independent from the counts of other species. The corresponding Poisson intensity parameter is efficiently estimated by maximum likelihood. It is reasonable to assume for each of the observed species, that its Poisson intensity parameter was not small and that the probability of observing at least one individual in the whole region of interest must have been larger than a value π close to one, since this species was actually observed. The non observed species are consequently assumed here to have small Poisson intensity parameters, all smaller than a given value λ, that depends on π. A Gamma distribution, truncated below at λ, is proposed as the distribution of the expected values (the Poisson intensity parameters) of the counts of the different observed species. A hierarchical statistical model is involved.

The estimated Gamma distribution for a data set is very informative about the behaviour of species abundances in the corresponding region. It can be used to compare two or more locations, or the same location across time. A comparison is made to other approaches such as RAD curves and other types of species abundance distributions as the ones presented in Magurran and Mc Gill (2011). Other distributions such as the lognormal could be considered as well, instead of the Gamma. The above ideas are exemplified with a reptile and tree data sets from the ecological reserve area of Chamela at Mexico.

References

Magurran, A. E. and McGill, B. J. (2011) *Biological Diversity*. New York: Oxford University Press.