Gamma Distribution

The gamma distribution, like the lognormal distribution, is an alternative to consider for ecological variables that seem to be highly skewed. If the random variable Y is gamma-distributed with parameters α and β, then the likelihood of Y is

$$p(Y) = \frac{\beta^{\alpha}}{\Gamma(\alpha)} Y^{\alpha-1} e^{-\beta Y}$$

where the gamma function $\Gamma(x)$ is defined as

$$\Gamma(x) \equiv \int_0^{\infty} t^{x-1} e^{-t} dt$$

As in the lognormal distribution, Y and the parameters α and β must be positive.

The parameter α is called the shape parameter. The parameter β is called the inverse scale parameter, i.e. the standard deviation of the gamma distribution is proportional to 1/β.

The mean of a gamma-distributed variable is α / β. The variance is α / β². If α > 1, then there is a mode which is (α-1) / β.

Some examples of gamma distributions are plotted below. Notice that the modes shift to the right as the ratio of α / β increases.