1 A hurdle model of fossil observation

A common occurrence in count data is an over-abundance of zeroes than would be expected from a Poisson distribution. Two common models for increasing the probability mass of a zero count are zero-inflated CITATION and hurdle models CITATION. These models are both mixtures of a Bernoulli distribution and some other discrete probability distribution commonly a Poisson distribution.

In this study we use a Hurdle model which is a mixture model of a Bernoulli and Poisson distributions. In this type of model zeroes are modeled seperately from the non-zero counts which implies two seperate processes have generated the data.

The probability mass function for a basic Hurdle model is defined as

$$p(y|\theta,\lambda) = \begin{cases} \theta & \text{if } y = 0, and \\ (1-\theta)\frac{Poisson(y,\lambda)}{1-PoissonCDF(0|\lambda)} & y > 0. \end{cases} \tag{1}$$