Alternative observation models

In previous chapters we considered various models of *encounter probability*, both in terms of parametric functions of distance and also a myriad of covariate models. However, we have so far only considered a specific probability model for the observations (we'll call this the “observation model”) -- the Bernoulli encounter process model which, in secr, is the *proximity detector* model. This assumes that individual and trap-specific encounters are independent Bernoulli trials. In this chapter, we focus on developing additional observation models. The observation model could be thought of as being determined by the type of device -- or the type of “detector” using the terminology of secr. We consider models that apply when observations are not binary and, in some cases, that do not require independence of the observations. For example, if sampling devices can detect an individual some arbitrary number of times during an interval, then it is natural to consider observation models for encounter frequencies, such as the Poisson model. Another type of encounter device is the “multi-catch” device, which is a physical device that can capture and hold an arbitrary number of individuals. A typical example is a mist-net for birds. It is natural to regard observations from these kinds of studies as independent multinomial observations. A related group of devices that produces *dependent* multinomial observations are the so-called *single-catch* traps. The canonical examples are small-mammal live traps which catch and hold a single individual. Competition among individuals for traps induces a complex dependence structure among individual encounters. To date, no formal inference framework has been devised for this method although the independent multinomial model can be a good approximation. The final sampling method we cover in this chapter involves acoustic recording devices, and we explain how to analyze the resulting data. Throughout, several worked examples are presented using using **JAGS** and secr.

Keywords: acoustic sampling, encounter probability, detection function, observation model, Poisson model, multinomial model, proximity detector, count detector, multi-catch detector