MODELING OBSERVER EFFECTS ON ANIMAL DENSITY AND DETECTION FOR COMBINED DISTANCE AND CAPTURE-RECAPTURE DATA

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The estimation of animal density using distance sampling methods generally ignores the effects of survey transects or observers on local animal density or detection probability. Typically, density is assumed to be uniform around the transect, which fails to allow for avoidance of or attraction to the transect by an animal species, while detection probability must be perfect on the transect, which may be untrue for many species. We propose parametric models for combined distance and capture-recapture survey data from line and point transect surveys that allow for two types of movement: permanent avoidance of or attraction to a transect, or temporary displacement of animals in the vicinity of a transect. The models have a simple form, with parameters that quantify the effect of transects and observers on local density. We combine these density models with linear-logistic models for detection probability using the likelihood framework of Borchers et al. (1998) for combined distance and capture-recapture data, which allows us to separately estimate the parameters of the density and detection components of the model. Through a simulation study, we show that provided sufficient animals are detected, the model parameters have little bias, and can lead to improved density estimates over the uniform model. Model selection by AIC generally chooses the correct density model. We apply our models to a point transect survey of birds in the Great Smoky Mountains National Park.