

# Local abundance and detection bias in a territorial songbird

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*N*-mixture models provide estimates of abundance while incorporating uncertainty in the detection process. An overlooked assumption of these models is that detection of individuals is independent of local abundance. We surveyed for the endangered Golden-cheeked Warbler (*Setophaga chrysoparia*) at six study sites in the Balcones Canyonlands Preserve, Austin, Texas (USA) in 2008 and 2009. *N*-mixture model estimates of abundance deviated from estimates based on spot mapping in a density dependent manner. In 2009, we estimated per capita singing rate of warblers at survey stations. We then tested whether detection of individuals is influenced by conspecific abundance by assessing per capita song rate in relation to abundance. We found a significant positive relationship between per capita song rate and spot-mapped abundance. This result illustrates how the behavior of this territorial species may violate an assumption of *N*-mixture models and potentially lead to erroneous estimates of abundance. We further explored this bias by applying *N*-mixture models to simulated data exhibiting a specified density-dependent detection process. This exercise revealed an underestimation of abundance at high bird densities (> 3 individuals per station) and both under- and over-estimation at lower densities. The empirical and simulated data suggest that density-dependent detection can lead to mis-estimation of abundance.