

Discussing problems vs. finding solutions: an operational framework for dealing with imperfect detection in species distribution modelling

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Abstract: Methods for dealing with imperfect detection have gained increasing attention in species distribution models (SDMs), yet there seems to be more discussion of the problems than efficient solutions. Part of the issue is that many historical and current data sets have been collected without multiple-visits to locations, thus conventional models based on multiple visits are not applicable. Another problem is the lack of standardized protocols when combining disparate data sets in order to cover larger geographic areas for SDMs. We show that recently proposed methodologies (single visit based N-mixture models; Sólymos et al. 2012) allow for correcting for detection error without replicate surveys; and that using a subset of the data to develop correction factors based on a combination of removal and distance sampling can be used to correct for imperfect detection while dealing with variation in survey protocols (QPAD approach; Sólymos et al. 2013). The QPAD approach can be used in combination with common modelling techniques including GLMs, GAMs, GLMMs, and regression trees. A common feature of these methods is the use of conditional maximum likelihood estimators that lead to reduced computation when fitting complex models to large data sets. These methods are also cost effective enabling ecologists to cover a larger geographical region than possible when having to return to sites. We use bird point count surveys from the Boreal Avian Modelling Project and the Alberta Biodiversity Monitoring Institute to demonstrate some of the possible applications of these methodologies for conservation and management of species over large spatial scales.

References

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