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Bayesian modelling on the expected extinction time of species.

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In this study, we propose a new Bayesian approach to calculate the expected extinction time of a species based on historical sighting record data. Unlike other work, our model allows comprehensively for uncertainties, provides the expected extinction time and the probability of extinction. It is extremely difficult to determine whether a species is extinct based on historical sighting records because knowing whether the last surviving individual of a species has finally died, or is just unobserved, remains problematical. Moreover, an incorrect classification of a species as extinct can lead to failure in conserving a threatened species. On the other hand, it is also undesirable to classify a species as extant when it is actually extinct as it can lead to misallocation of funds. Sightings with uncertain validity (uncertain sightings) play an important role in the inferences made and need to be taken into account better than they have been. Recent studies have considered uncertain sightings while making inferences about extinction; however, the difficulty of the problem requires making a number of limiting assumptions that significantly reduce realism. We have attempted to derive a more general model by incorporating sighting validity into a new Bayesian model development. We employ the underlying idea of the beta-geometric/beta-binomial (BG/BB) model to build our Bayesian approach for the analysis of extinction. Using the likelihood for the sighting data, along with the prior distributions of sighting probability and extinction probability, we calculate the expected extinction time using a Markov Chain Monte Carlo (MCMC) method which we simulate with JAGS. We apply this new approach to the sighting records of Caribbean monk seal (CMS), Dodo and Ivory-Billed Woodpecker species. Unlike other approaches that consider uncertainties in the sightings, our model gives Bayesian confidence intervals for the expected extinction time of a species.

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