

2.c. Using BAYESIAN STATISTICS to estimate dolphin population size

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The problem

Selecting the most appropriate mark-recapture model for estimating bottlenose dolphin (*Tursiops truncatus*) abundance in the coastal waters around NE Scotland.

Data available

Photographic identifications of individual dolphins from three spatially distinct study sites



Identification photographs of individual bottlenose dolphins

Why use this method and not another method?

The study design was not tailored to suit a specific model, so we needed to use the data to select between a suite of candidate models representing different hypotheses about dependence between study sites. The Bayesian approach quantified uncertainty about model selection by estimating the probability of candidate models, and estimates of abundance included model selection uncertainty by averaging across candidate models.

Simple description of how it was done

Photographic “captures” of dolphins in different study areas were summarised in a simple contingency table, where cell counts represented the number of individuals captured (or not) in each combination of the three study sites. The 000 cell, representing the number of individuals not identified in any of the areas, was treated as missing data. Bayesian Markov chain Monte Carlo (MCMC) was used to fit log-linear models to the count data, and estimate the value of the missing cell. Binary indicator variables were included to specify alternative model forms by switching dependence parameters in and out of a general model, and the MCMC approach sampled across the discrete distribution of candidate models to provide a model-averaged population estimate.

Software used and alternative generic packages that could be used

WinBUGS v1.3 was used (<http://www.mrc-bsu.cam.ac.uk/bugs/welcome.shtml>). Any software for fitting generalised linear models using MCMC.

Reference

Durban, J.W. et al (2005). Multi-site mark recapture for cetaceans: population estimates with Bayesian model averaging. *Marine Mammal Science* 21,XX-XX.

Further reading

Morgan, B.J.T. (2000) Applied Stochastic Modelling. Arnold Publishers, London, UK.