Implications of the grid spacing on the quality of spatially predicted species abundances

Olga Lyashevska[a], **Dick J Brus**[b] and **Jaap van der Meer**[a]

[a]Department of Marine Ecology
NIOZ Royal Netherlands Institute for Sea Research
P.O. Box 59 1790 AB Den Burg
Texel, The Netherlands
olga.lyashevska@nioz.nl

[b]Alterra
Wageningen University and Research Centre
P.O. Box 47, 6700AA
Wageningen, The Netherlands

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Abstract:
The effect of grid spacing on spatial prediction of species abundances was estimated. Data on counts of intertidal macrofauna (*M. balthica*) were collected in the Dutch Wadden sea over a grid of 500×500 m. The first step in the procedure was modelling of the zero-inflated data without taking spatial dependency into account. The problem of excess zeros was addressed through a mixture model (Lambert, 1992) which allowed to distinguish the point mass at zero through a Bernoulli process and the count component through a Poisson process. In the second step spatial correlation in both processes was then accounted for through generalised linear geostatistical model (GLSM) (Diggle et al., 1998; Christensen, 2004). Using simulations from the conditional distribution by MCMC a Monte Carlo approximation to the likelihood function was made. In the third step the two calibrated GLSMs were used to generate 100 pseudo-realities. This was done by conditional simulation from the original grid to the nodes of a fine prediction grid (100×100 m) supplemented with 1000 randomly selected validation points. The simulated pseudo-realities of the Bernoulli variable and the Poisson variable were combined into 100 pseudo-realities of a zero-inflated Poisson variable. In the fourth step each simulated pseudo-reality was repeatedly sampled by grid sampling with a varying spacing. Each sample was used to predict the study variable at the validation points by inverse distance weighted interpolation, and to estimate the Mean Squared Error (MSE). By averaging the MSEs over the pseudo-realities an estimate of the model-expectation of the MSE was obtained. The results showed that the decrease in resolution of the sampling grid (upscaling) had a clear effect on the precision of the predictions. This has direct implications for decisions with respect to sampling density for ecological monitoring programmes.

References

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