

Modelling Individual Animal Growth in Random Environments

Patrícia A. Filipe¹ and Carlos A. Braumann¹

¹ Universidade de Évora, Centro de Investigação em Matemática e Aplicações
Rua Romão Ramalho, 59, 7000-671 Évora, Portugal
pasf@uevora.pt, braumann@uevora.pt

Abstract: We have considered, as general models for the evolution of animal size in a random environment, stochastic differential equations of the form $dY(t) = b(A - Y(t))dt + \sigma dW(t)$, where $Y(t) = g(X(t))$, $X(t)$ is the size of an animal at time t , g is a strictly increasing function, $A = g(a)$ where a is the asymptotic size, σ measures the effect of random environmental fluctuations on growth, and W_t is the Wiener process. We have considered the stochastic Bertalanffy-Richards model ($g(x) = x^c$ with $c > 0$) and the stochastic Gompertz model ($g(x) = \ln x$). We have studied the problems of parameter estimation for one path and also considered the extension to several paths. We also used bootstrap methods. Results and methods are illustrated using bovine growth data.

Keywords: growth models; stochastic differential equations; estimation; cattle weight.