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Mathematical biology: Stochastic differential equations modelling examples

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Abstract

The dynamics of some biological phenomena are frequently modelled using ordinary differential equations (ODE). However, quite often random environmental fluctuations do affect the dynamics of these phenomena in a significant way and, besides causing considerable deviations from the mean dynamics, may also produce new qualitative features. Incorporating the effect of random environmental fluctuation leads to stochastic differential equation (SDE) models. We will present a few applications of SDE models in Mathematical Biology, based on some recent and some not so recent publications of the author and the co-authors Patrícia A. Filipe, Clara Carlos

and Nuno M. Brites. Namely, we will address: (i) Models for the growth of animal populations, including the qualitative behaviour of general models (in what concerns extinction and existence of a stationary density) and the effect of using approximate models; (ii) Harvesting models and profit optimization using variable and constant fishing efforts; (iii) SDE and mixed models for individual growth of animals with applications to profit optimization of bovine growers.

Keywords: Stochastic differential equations, population growth, random environments, harvesting models, individual animal growth.

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References

[1] C.A. Braumann, *Introdução às Equações Diferenciais Estocásticas*, Edições SPE, Lisboa, 2005.

[2] C.A. Braumann, Growth and extinction of populations in randomly varying environments, *Computers and Mathematics with Appl.*, 56, pp. 631–644, 2008.

[3] N.M. Brites and C.A. Braumann, Fisheries management in random environments: Comparison of harvesting policies for the logistic model, *Fisheries Research 195: 238-246*, 195, pp. 238–246, 2017.

[4] P.A. Filipe, C.A. Braumann, and C. Carlos, Profit optimization for cattle growing in a randomly fluctuating environment, *Optimization*, 64(6), pp. 1393–1407, 2015.