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A stochastic model to mathematically describe the dynamics of long-lived raptor species

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The main motivation behind this talk is the study of stochastic models to describe the demographic dynamics of long-lived raptor species. The methodology based on population viability analysis, considered in conservation biology and in the management of threatened or endangered species, usually requires information about several variables (sizes, ages, mortality rates, growth rates, environmental variables, etc). In practise, taking into account the particular characteristics of these raptor species (monogamous behaviour, stability of their couples, marked natal philopatry, similar reproductive strategy, etc) real data about such variables are difficult to obtain. Mathematical models based on others methodologies have not been sufficiently investigated. In this biological scenario, branching processes could provide appropriate mathematical models.

We present a model that requires an information feasible to be observe. It considers the calendar year as unity of time and assumes an environment changing, stochastically in time, influenced by the reproductive age of the females. From such a model, we investigate several inferential problems of ecological interest for these raptor species. In particular, with the purpose to forecast possible changes in their population dynamics, we estimate the most relevant reproductive parameters included in the mathematical model. To this purpose, we use a procedure based on Approximate Bayesian Computation methods.

This statistical methodology requires to perform a large number of simulation from the probability model. The parameters necessary to carry out these simulations are generated from a suitable prior distribution based on the previous knowledge of the species under study. As illustration, using real data of counts of the number of couples in the population, we apply the proposed methodology to describe the demographic evolution of two black vulture colonies

located in the region of Extremadura (Spain) which are considered both the largest and densest breeding colonies worldwide.

Keywords: biological population dynamics, long-lived raptor species, stochastic modeling, statistical inference

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