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# A statistical investigation into the properties and dynamics of biological populations experiencing environmental variability

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## ***Abstract***

Much research has been devoted towards the understanding of population behaviour. Such understanding has often been furthered through the development of theoretical population models. This research report explores a variety of population models and their implications.

The implications of the various models are explored using both analytical results and simulations. Specific aspects of population behaviour studied include gross fluctuation characteristics and extinction probabilities for a population.

This research report starts with an overview of Deterministic Models. This is followed by a study of Birth and Death Processes, Branching Processes and Models that incorporate environmental variability. Finally, we study the maximum likelihood approach to population parameter estimation. The more notable theoretical results derived include: the development of models that incorporate the population's history; models that incorporate discontinuous environmental changes and the development of a means of parameter estimation for a Stochastic Differential Equation.