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INTERACTIONS BETWEEN SPECIES: SOME COMPARISONS BETWEEN DETERMINISTIC AND STOCHASTIC MODELS[1]

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Introduction. Mathematical descriptions of the growth of interacting populations have been attempted since Lotka (1925) and Volterra (1926) first published their equations. The arguments for mathematical modeling of such processes are that such descriptive models provide a potential for successful prediction of future conditions and by manipulation of mathematical models one may obtain insight into the response of the interacting system due to changes in conditions. Furthermore mathematics provides a means of accurate communication between biologists. The earlier work in the mathematical theory of interacting species was generally formulated without reference to the randomness inherent in biological processes. A comprehensive treatment of the deterministic models of Lotka (1925), Volterra (1926), Thompson (1939), Nicholson and Bailey (1935), etc., may be found in the book by D'Ancona (1954).

The development of stochastic models to describe the growth of interacting populations has been hampered by the more difficult mathematics involved in solving the differential equations or difference equations. However, the presence of fast computers has encouraged some Monte Carlo studies of the stochastic models by Bartlett (1957), (1961), Leslie and Gower (1958), (1960), and Barnett (1962). Exact analytic solutions of the stochastic models are very scarce, except for greatly simplified models such as those considered by Weiss (1963), (1965), Dietz and Downton (1968) and Becker (1970a), (1970b). While these models are oversimplified they have the advantage of lending themselves to analytic solution and are hence ideally suited for a

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