

ABSTRACT

Analysis of predator-prey models is one source of information for managing the interactions among species in different ecosystems. Factors such as over-exploitation drive many species to extinction. The conservation of these species depends on appropriate initiatives, such as the establishment of protected areas. Models involving four species with prey refuge and type I responses have been studied with recommendations on their extension to include either a type II or type III responses. However, models with Holling type II responses are de-stabilizing according to most studies; with recommendations on incorporating type III responses which enhance the coexistence of species. In this study therefore, a mathematical model with prey refuge and a type III response is formulated and analyzed. The objectives of the study were: To formulate a model of four species predator-prey system with prey refuge and Holling type III response, to determine the prerequisites for the solutions' existence, uniqueness, positivity, and boundedness, to determine the stabilities of the steady states and to perform numerical simulations of the model. The methodology involves the use of Lipschitz criterion, descartes rule of signs, determinants and eigenvalues, Routh-Hurwitz criterion, Lyapunov technique, as well as carrying out numerical simulations using MATLAB. The reserved zones could enhance the survival and stability of multi-species interactions according to the results obtained. The findings of this study may be applied to a variety of situations including; resource conservation, pest management, among others.