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Dynamics of a delayed toxin producing plankton model with variable search rate of zoo-plankton. (English) Zbl 07487724

Summary: In this work, we have investigated a phytoplankton-zooplankton model system such that the toxic liberation by toxic producing phytoplankton obeys a discrete time lag. Here, we have taken modified Holling type II functional response, based on the fact that search rate of zooplankton depends on the biomass of phytoplankton, rather than constant. The similarities but also important differences between our studied model and Holling type II system are discussed. The basic dynamical properties of the proposed model have been studied briefly in absence of delay factor. Next, we have analyzed the dynamic nature of the delayed system and also found the existence of stability switching phenomena. Numerical simulations are conducted to validate our analytical findings using MATLAB. Numerically, the phenomena of bistability has been recognized. Lastly, our proposed deterministic system has been compared with a stochastic model using Gaussian white noise terms due to the effect of environmental fluctuations.

MSC:
92-XX Biology and other natural sciences
82-XX Statistical mechanics, structure of matter

Keywords:
toxic phytoplankton; variable search rate; stability; local bifurcations; time-delay; Gaussian white noise

Full Text: DOI

References:


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