Numerical investigation of diffusive predator-prey model with application to annular habitat

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A simplified diffusive predator-prey model of the Lotka-Volterra type is considered for annular habitat which is used for description of predator and prey coexistence at habitats surrounding lakes, mountains at particular heights,etc. The model is formulated as a system of two partial differential equations in which unknown populations of the predator and prey are described by functions depending on time and polar angle. A mixed problem is formulated so that the boundary conditions are 2π-periodic and in the initial conditions is assumed that populations of the predator and prey are completely separated on the annular habitat. The problem is solved by the method of lines by means of which the original system of partial differential equation is converted to the system of several hundred nonlinear ordinary differential equations. It's shown that predator and prey start slowly propagating through the annular habitat and their interaction commences after a time interval in the course of which the population of the predator is decreasing and the population of the prey is increasing. An intensive interaction of the predator and prey occurs after their meeting. The dynamics of the transient populations of predator and prey and the tendency of their steady state is analyzed.

References

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