

元胞自动机在鱼群繁殖与捕食模型中的应用

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摘要: 元胞自动机 (cellular automata, CA) 是一种对于复杂空间结构有较强表达性的离散动力学系统, 其转化规则和模型参数是元胞自动机的核心。通过建立元胞自动机模型模拟鱼类种群繁殖与捕食行为, 探讨鱼群在不同捕食压力之下种群数量的变动特征。在建立四格网络活动区域, 设定定值型边界的基础上, 通过元胞自动机自复制功能模型, 采用冯·诺伊曼模型邻居, 设立繁殖规则模拟种群数量变动。在区域中建立捕食者与被捕食的二维正态分布, 同时建立生态学规则, 模拟鱼群捕食关系下的变动特征。本研究分别模拟了鱼群随时间的变动, 并结合元胞自动机模型, 给出不同捕食策略下捕食者与被捕食者的种群变化, 并分析了捕食策略, 种群密度, 种群分布对于其种群数量变动的影响。

关键词: 元胞自动机; 种群密度; 鱼群; 生态学

The application of cellular automata for school reproduction and predation

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Abstract: Cellular automata (CA) is one of powerful expression of discrete dynamic system in complicated spatial structure. The core of CA is transformation rule and model parameters. By simulating the reproduction and predation of fish school, the population dynamics can be described through the predation pressure variously. The fourfold area and definite boundary value are established for CA, and Von Neumann's Neighbor and reproduction rule are established for population variation. To simulate the characteristic of fluctuation under the circumstance of predatory relation, two-dimensional normal distribution of predator and prey is set up in checked area as well as ecological regulation. This research also manifests population changes in different strategies and the quantity of the school of fish, and analyzed the quantitative influence of the predatory strategies, population density and population distribution.

Key words: cellular automata, population density, school of fish, ecology