

Construction of a Predator–Prey Model and its Mathematical Study

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Abstract

Water level may influence local community dynamics. We examine how seasonal variations in water level affect the outcome of prey–predator interactions in Parloup Lake, in the south of France. We propose a new model to describe the annual cycle of persistence, using the continuation theorem of coincidence degree. An important property of the proposed model is that it contains coefficients that may jump instantaneously, reflecting temporal variations in local conditions. We consider the challenging question of the existence of a positive periodic solution.

Mathematics Subject Classification: 34C25, 34D05, 37N25, 92D25, 92D40, 47H11.

Keywords and phrases: Prey–predator model; functional response; water level; periodic solution; coincidence degree theory; Mawhin’s continuation theorem; persistence; predator interference; logistic growth; a priori estimates.

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