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Predator-prey models with distributed delay: numerical exploration

We are considering predator-prey models with the delay between the consumption of prey to the conversion to predator biomass incorporated. Doing so results in oscillatory behaviour of solutions even in the systems with predator functional responses as simple as the Holling I. In this study we have considered distributed delays and hence modelled the dynamic with integro-differential equations. The point of interest is how different would the resulting dynamics be across various distributions? Or, what is the set of characteristics across parameter space and distributions that will result in the model exhibiting similar dynamics? Local stability analysis shows that systems with various distributions of delay share quite a few properties.

From both mathematical and biological points of view the most interesting dynamics are these of sustained population of both predator and prey. Due to tractability issues these dynamics are hard to establish theoretically. Therefore, we employed numerical bifurcation tools such as XPPAUT and DDEbifTool software to study the local dynamics around coexistence equilibrium and to establish conditions upon which the behaviour of solutions across the systems with various distributions are similar to each other and comparable to the solutions of the system with the discrete delay.