Stability analysis of a single-species logistic model with time delay and constant inflow

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We consider a single-species system with distributed delay and constant inflow. First, we consider the case with time delay in which the constant inflow does not exist. The condition of Hopf bifurcation for the delay order of k = 2 is known, but is not given clearly for the delay order of k ≥ 3. We have obtained the relationship among systems parameters for Hopf bifurcation. Next, we consider the case in which the constant inflow exists. In this case, the positive equilibrium changes to be unstable from being stable first, and return to be stable again by increasing with average time delay T for small intrinsic growth rate r. It is found that there exists important difference between the delay orders $k = 2$ and $k \geq 3$. For $k = 2$, the equilibrium can be stable for large T and any $r(> 0)$, but for $k \geq 3$, the equilibrium is unstable for large T and r .