The dynamics of the γ-Ricker model of order two[1]

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We consider the population model given by the order two difference equation

$$x_{n+1} = ax_n^{\gamma} e^{-x_n - \rho x_{n-1}}, \tag{1}$$

where $x_n \geq 0$, $a > 0$, $\rho \geq 0$ and $\gamma \geq 1$. When $\gamma = 1$ and $\rho = 0$, we obtain the classical Ricker model [5]. The parameter γ was introduced in [1] as cooperation in the population and produces the so-called Allee effect, giving the extinction of the species when the population is small enough [3]. An extension of the Ricker model to order two was proposed, for instance, in [4, 2] in which the parameter $\gamma = 1$. Here, we introduce the cooperation parameter γ to be greater than one and study the existence of the Allee effect for the model. We explore the local and global dynamics of the model.

References

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[1] Collaborative work with María Muñoz-Guillermo