Dynamics of a single species in a fluctuating environment

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In this talk, we discuss the dynamics of a population in a fluctuating environment. We assume that the evolution of a species is described by the logistic differential equation

$$\frac{\mathrm{d}x(t)}{\mathrm{d}t} = r(t)x(t)\Big(1 - \frac{x(t)}{K(t)}\Big),$$

where the intrinsic growth rate r and the carrying capacity of the environment K are positive, continuous functions that vary periodically with time, $r(t+T) = r(t)$ and $K(t+T) = K(t)$, for all $t \in \mathbb{R}$.

Existence of periodic solutions, their stability properties, and behavior of other solutions are discussed in several cases:

(i) intrinsic growth $r(t)$ is not necessarily positive [3];

(ii) Allee effect, described by a nonlinear differential equation

$$\frac{\mathrm{d}x(t)}{\mathrm{d}t} = r(t)x(t)\Big(1 - \frac{x(t)}{K(t)}\Big)\Big(\frac{x(t)}{K(t)} - \frac{A(t)}{K(t)}\Big)$$

with periodic coefficients [1];

(iii) periodic yield harvesting [2], modeled by a nonlinear differential equation

$$\frac{\mathrm{d}x(t)}{\mathrm{d}t} = r(t)x(t)\Big(1 - \frac{x(t)}{K(t)}\Big) - H(t).$$

This is a joint work with Fatma Bayramoğlu Rizaner, Mustafa Hasanbulli and Yuriy Rogovchenko.

References

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[3] *S. P. Rogovchenko, Yu. V. Rogovchenko*: Effect of periodic environmental fluctuations on the Pearl-Verhulst models. Chaos Solitons Fractals *39* (2009), 1169–1181.