VII International Conference on Mathematics and its Applications in Science and Engineering
(ICMASE 2026)

ICMASE 2026

IMPACT OF FEAR ON PREY IN A LESLIE-GOWER TYPE MODEL WITH GENERALIST PREDATORS

Alejandro Rojas-Palma[1,*], Francisco Reyes-Bahamón[2], Eduardo González-Olivares[3]

[1]*Departamento de Matemática, Física y Estadística,*
Facultad de Ciencias Básicas, Universidad Católica del Maule, Talca, Chile
[2]*Universidad Surcolombiana, Neiva, Huila, Colombia*
[3]*Pontificia Universidad Católica de Valparaíso, Chile.*

ABSTRACT

Different ecological phenomena have been included in the study of the interaction between a prey and its principal predatory population.

Facts as refuge use by prey, or actions as the formation of group of defence are some of these disturbances in the important interrelation.

In this paper, a Leslie-Gower-type predation model assuming that populations act with fear of facing predators is analyzed, which is described by a nonlinear ordinary differential equation system (ODEs).

The model's dynamical properties including boundedness, positivity, extinction criteria, and the existence and stability (both local and global) of equilibrium points are rigorously examined.

We will consider how the collective fear of prey towards their predators affects the growth rate of the prey. Furthermore, his ecological phenomenon can be mathematically described by different functions. For example, the function $f(\alpha, \eta, y) = \eta$, express the fear, showing that if the predator population increases in the environmental, the prey population experiences minimum fear pressure from the predator species.

One of the purposes of this work is to point out that some of these new systems with such modifications can have the same topological portrait in the phase plane as the original one.).

***K*eywords** Predator-prey, bifurcation, stability

References

[1] A. A. Berryman, A. P. Gutierrez, R. Arditi. Credible, parsimonious and useful predator-prey models - A reply to Abrams, Gleeson, and Sarnelle. Ecology 76 (6) (1995) 1980-1985.

[2] B. Belew, Analyzing the effect of fear, and refuge on prey, harvesting, and hunting cooperation among predators on Leslie-Gower predator prey model, International Journal of Differential Equations Volume 2025, Article ID 4548428, 25 pages.

[3] M. He and Z. Li, Stability of a fear effect predator-prey model with mutual interference or group defense, Journal of Biological Dynamics 2022 16(1) 480-498.

[4] P. H. Leslie, Further notes on the use of matrices in Population Mathematics, Biometrika, 35(3/4) (1948) 213-245.

[5] P. H. Leslie and J. C. Gower, The properties of stochastic model for the predator-prey type of interaction between two species, Biometrica 47 (1960) 219-234.

[6] Y. Li and D. Xiao, Bifurcations of a predator-prey system of Holling and Leslie types, Chaos, Solitons and Fractals 34 (2007) 606-620.

[7] K. Sarkar and S. Khajanchi, Impact of fear effect on the growth of prey in a predator-prey interaction model, Ecological Complexity 42 (2020) 100826.

[*]*Corresponding Author's E-mail: amrojas@ucm.cl*