

# The Hunting Cooperation of a Predator under Two Prey's Competition.

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**Journal:** Special Issue: Recent Developments in the Mathematical Modeling and Analysis of the Infectious Disease Problems. AIMS Mathematics 2022, Volume 7, Issue 4: 5463-5479. [DOI: 10.3934/math.2022303](https://doi.org/10.3934/math.2022303) (SCIE, impact factor 1.427, Q2)

The Hunting Cooperation of a Predator under two prey's competition and fear-effect in the prey-predator fractional-order model

**Publication date:** 2022/1/7

## Abstract

This paper investigates a fractional-order mathematical model of predator-prey interaction in the ecology considering the fear of the prey, which is generated in addition by competition of two prey species, to the predator that is in cooperation with its species to hunt the preys. At first, we show that the system has non-negative solutions. The existence and uniqueness of the established fractional order differential equation system were proven using the Lipschitz Criteria. In applying the theory of Routh-Hurwitz Criteria, we determine the stability of the equilibria based on specific conditions. The discretization of the fractional-order system provides us information to show that the system undergoes Neimark-Sacker Bifurcation. In the end, a series of numerical simulations are conducted to verify the theoretical part of the study and authenticate the effect of fear and fractional order on our model's behavior.