

# EKSISTENSI FENOMENA PARRONDO PARADOX PADA SISTEM PREDATOR-PREY DENGAN PEMBERIAN SWITCHING FUNCTION

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## ABSTRACT

This research focused on investigating the existence of the Parrondo paradox in a predator-prey system with 2 types of predators and 1 type of prey. In this predator-prey system, the first predator is negatively affected by two factors: the competition for food by the second predator against the first predator and human hunting of the first predator. The competition for food by the second predator against the first predator is expressed in the form of a switching function. Therefore, in the studied predator-prey system, there is a switching function that indicates that the level of competition for food by the second predator against the first predator increases as the prey population decreases.

The interaction between the two types of predators and the prey is modeled using a continuous dynamical system. Secondary data, representing the values of various parameters, were collected from various reference sources. Equilibrium points representing the conditions when the first predator faces extinction were then determined. The influence of changes in parameters representing the level of human hunting of the first predator on the stability of these equilibrium points was investigated. Initially, the impact of changes in hunting parameter on stability was examined when the parameter representing the competition for prey by the second predator against the first predator had a value of 0. Subsequently, the effect of changes in the competition parameter on the stability of equilibrium points was explored when the competition parameter, in the form of a switching function, was not equal to 0. Changes in stability due to these treatments indicate the occurrence of bifurcation, which can be associated with the Parrondo paradox.

The results of this study show that the equilibrium point representing the extinction of the first predator is more likely to be unstable when there is no competition for food parameter compared to when the competition parameter has a positive value. This instability of the equilibrium point suggests that the first predator will not face extinction. However, the Parrondo paradox occurs when the level of hunting of the first predator can be controlled so that the average death rate of the first predator is less than 9 individuals per year. If this control can be achieved, the first predator will continue to exist.

Kata Kunci: *Parrondo paradox, predator-prey, switching function*