

ABSTRACT

Mathematical Models of Crime

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Gang-related crime is becoming an increasing problem in Trinidad and Tobago. Since this is a relatively new phenomenon, there has been very little work directed towards modelling crime locally. This research used models adapted from Mathematical Biology to study three aspects of criminal behavior. The growth of gangs, the infiltration of gangs into the police service and the switching of territory by marauding criminal gangs with their capture by police were studied using an infectious disease model, an ecoepidemiological model and a predator-prey model respectively.

The dynamical behaviour of these systems were investigated with stability and bifurcation analyses, to explore the effect of different crime prevention strategies and to identify thresholds that determine the establishment or disappearance of criminals in the population. Results from the infectious disease model indicated that when parameters representing suppression, intervention and prevention strategies of gangs were varied, the greatest reduction in gang numbers occurred by combining these measures. Transcritical bifurcations representing extinction of gang members were found for the deterrence, contact and murder rate parameters. For the model representing “corrupt” police, there were five equilibrium states. Transcritical bifurcations were found for parameters related to the creation and capture of gang members and for the number of police so that even with the existence of corrupt police, control of gangs was possible. Finally constant effort and constant yield harvesting functions were applied to criminals switching between two areas. Numerical studies revealed that depending on parameter values, a stable equilibrium or a limit cycle was possible with both harvesting types so that the criminal and the prey populations in the two habitats oscillated periodically.

Keywords: Joanna Sooknanan; mathematical modelling of crime; bifurcations.