Cover Letter

Rhino species populations are at a critical level due to the demand of rhino horn and the subsequent poaching. Wild life managers, who are in charge of the protected areas, attempt to secure the life of the animal using several devaluing approaches. The most common approach is dehorning. Nonetheless, dehorning does not always repel the poachers. In order for dehorning to be successful a poacher must choose to only kill rhinos with full horns, thus be a selective poacher'. Indiscriminate poachers also exist, which are poachers who choose to kill all rhinos they encounter.

In 2016, the interaction between a rhino manager and poachers was investigated for the first time using a game theoretic model. The interaction was formulated as a two players normal form game where each player had a set of two actions. A manager could choose between dehorning or not, and a poacher could choose to behave selectively or indiscriminately. The paper discussed two of the nash equilibriam of the game and concluded that poachers will always choose to behave indiscriminately.

In this manuscript, we explore what circumstances would ensure that rhino dehorning is successful. Using evolutionary game theory we predict the strategies adopted by new poachers joining an existing population such that poacher outcome is maximised. This work contributes to ecological management through the understanding of poacher behaviour on a population dynamic level.

The game considered is not of a two player game anymore (manager and poacher) but now an infinite population of poachers is considered. The purpose of the work is to determine which strategy is preferred by a poacher in various different populations of poachers and whether conditions which encourage poachers to behave selectively exist. This is explored using both analytical and numerical methods. Analytical methods include investigating the underlying differential equations of the population.

The findings confirm that behaving selectively will not persist, not even in a mixed population using the fact that the only evolutionary stable strategy is the indiscriminate one. Meaning, that for any given starting population, the poachers would evolve to adopt an indiscriminate behaviour. However, our results reveal that it is possible for a population of selective poachers to exist, but for this to occur a disincentive must be applied to the utility of indiscriminate poachers. The disincentive factor can have several interpretations; such as engaging the rural communities that live with wildlife.