THE HINDU

Published: July 18, 2013 02:52 IST | Updated: July 18, 2013 02:52 IST

Modelling animal interactions

Shubashree Desikan

Physics models are increasingly being built to describe biological and ecological phenomena. The latest is a paper published in the journal *Physical Review Letters* (June 14), which models the grazing behaviour of Mongolian gazelles (*Procapra gutturosa*) and its relationship with their communication patterns.

Many animals communicate for various reasons: to ensure defence against predators, to share information on resources, to announce territories etc.

This communication leads to group formation. While the intention of the individual while communicating may be to ensure group formation (so that the individual is in less danger from a predator), it also ends up sharing resource information with the other members of the species. Clearly, these things work very efficiently and the aim of the paper was to understand how this efficiency is arrived at.

Ricardo Martinez-Garcia of the Instituto de Fisica Interdisciplinar y Sistemas Complejos, Spain, and co-workers, physicists and ecologists all, have modelled the movement of animals on a plane surface by particles moving in two dimensions. The conditions that influenced the movement of the animals were modelled by three terms.

One term represented the enticement offered by the richness of vegetation patches. The second term mimicked the communication between the animals, namely the call and the response of listening animals. The third term allowed for the random movement of the animals, what is called a “white noise.”

While earlier theoretical work had focussed on independent random walkers, this paper for the first time models interaction between random walkers taking into account communication between them, especially when the model is applied to foraging animals.

Some of the questions they seek answers to are: how can communication help group formation? Is there a communication range that optimises foraging efficiency?

In order to apply their understanding to a specific, real case, the researchers obtained the parameters of the model by observing 36 Mongolian gazelles over a period of four years. Having modelled the interactions as explained earlier, they couple the individual-based model with a data-based resources landscape.

A simulation showed that at intermediate communication frequencies of 1 kHz, all of the modelled animals end up in resource-rich areas. For smaller (0.1 kHz) or larger frequencies (15.8 kHz), some of the animals are still in low-quality areas at the end of the simulation period.

The result that the maximum response takes place for intermediate frequencies is in itself interesting but what is more important is that now there is a way to model interactions between and movements of groups of animals of a species and that it can be used to answer deeper questions.

Keywords: Mongolian gazelles, communication patterns, Physics models