

Ribbeting Content: A Frog Pursuit Model

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INTRODUCTION

Many species of frogs are known to exhibit 'toe twitching' while feeding. The exact reason for this behavior is unknown, but researchers speculate the vibrational and visual stimulation from this process encourages prey movement (Sloggett & Zeilstra, 2008).

OBJECTIVES

We aim to create an agent-based model for a system of one *Kaloula pulchra* and one *Blaptica dubia* which quantifies the impact of toe twitching and movement of each individual in the system. To construct this model, we recorded observations in a controlled environment during feeding encounters.

OBSERVATIONS

- Insects appear to move randomly when uninfluenced by frog
- Twitching appeared to draw insects towards frog
- Frog remained stationary unless in pursuit
- Frog begins pursuit once insect appears, moving, in

MATHEMATICAL APPROACH

The model needs equations for the velocity and acceleration of each agent. The acceleration equations will be constructed using first principles and the information obtained via observations.

Each agent in our model needs a self propulsion term to exponentially enforce a constant movement speed. This is the first term in our system on the right. In the roach acceleration equation, we can simply use a white noise function with diffusion D to represent their erratic movements.

Figure 1. Two male *Kaloula pulchra* displaying their long toe and distinctive stripes

RESULTS

We wrote a MATLAB script to run simulations using the model we created. Upon running the script, the simulations match the observations recorded during feeding sessions. The frog remained stationary as the roach slowly traveled towards it, until ultimately getting devoured.

Figure 4. Still frames from a simulation in MATLAB

FUTURE WORK

We plan to nondimensionalize our system to simplify the model and remove units. We can also increase the number of frogs or roaches in the system with minor tweaks.

References

- Sloggett, J. J., & Zeilstra, I. (2008). Waving or tapping? Vibrational stimuli and the general function of toe twitching in frogs and toads (Amphibia Behaviour, 76(5), e1–e4.
<https://doi.org/10.1016/j.anbehav.2008.08.005>

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Figure 2. Still frame from feeding recording. Roach is above the frog

Figure 3. A diagram illustrating the process of computing