

## **Should I stay or should I go? Optimal decisions for attack and flight during predator-prey interactions**

*POLNASZEK, Timothy\**; *ARTITA, Kimberly S.*; *SEARS, Michael W.*; *Southern Illinois University*; *Southern Illinois University*; *Southern Illinois University* [tpolnasz@siu.edu](mailto:tpolnasz@siu.edu)

One of the most important decisions that a prey makes during its lifetime is if and when to flee from a predator. To date, all theoretical treatments of flight initiation predict that a prey should flee when it detects a predator in the environment. However, prey might gain considerably by not fleeing if they are successfully cryptic or if predators fail to attack. Previous models of flight initiation make very simple assumptions regarding the detectability and perceptual abilities of predators and prey; e.g., prey are always detected when they are within a specified perceptual distance from the predator. Here, we relax these assumptions for both predator and prey by allowing the probabilities of detection to decay with distance and direction according to a set of probability density functions. These probability density functions define the perceptual ranges of the predator and prey. By modifying shape parameters of these probability distributions, we simulated several types of searching strategies for predators and vigilance strategies for prey. Assuming that individuals want to maximize net energy intake per time, we simultaneously solved for the optimal probabilities of prey flight and predator attack during these simulations using evolutionary algorithms. Contrary to earlier models, we found that prey do not necessarily flee once they have detected a predator, nor do predators immediately attack once a prey is detected. This result is likely a direct consequence of imperfect perception and detectability of the predator and prey. Future directions for this work include directly linking predator and prey strategies to fitness (as a function of age), and searching for multiple strategies indicative of predator-prey games under different abundances and distributions of prey.