

Co-evolution of a predator-prey fish schooling model



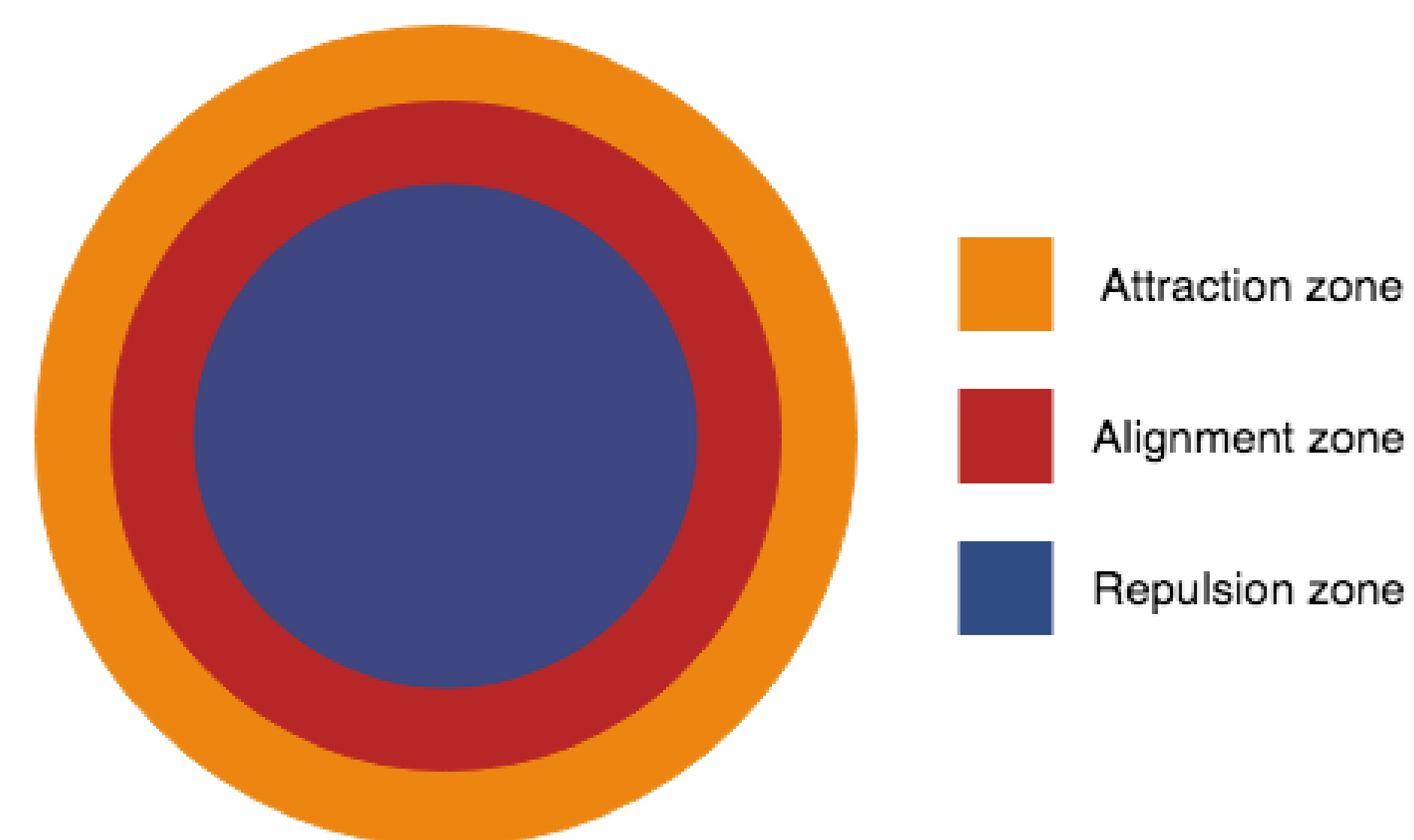
Martijn Messanella / Jan Schutte / Daan Vinken / Laura Zwaan

RESEARCH QUESTION

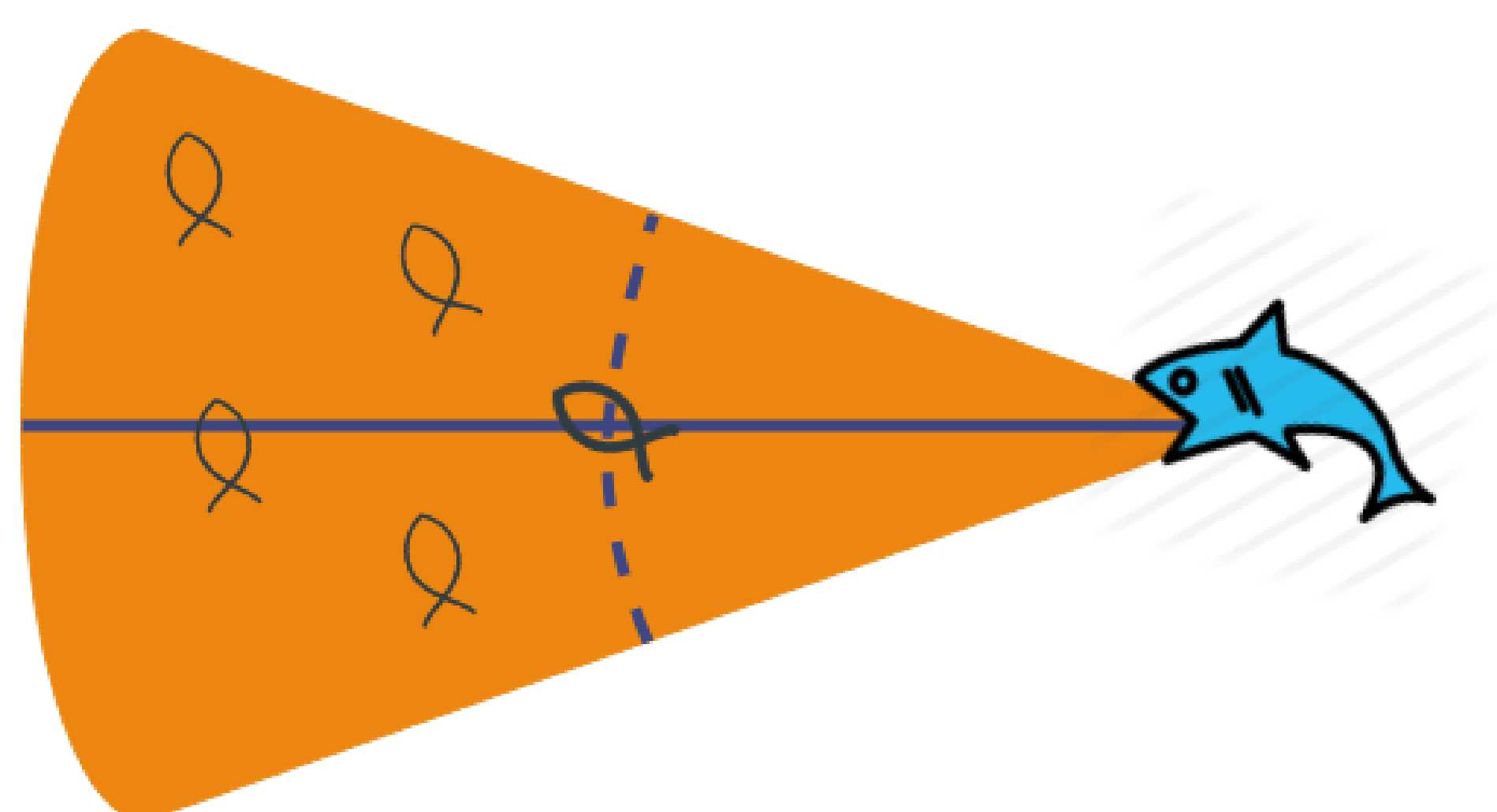
How do the parameters of a co-evolutionary individual-based model affect the emergent behaviour of schooling fish attacked by a predator?

MODEL: PREY/PREDATORS

- Prey seek out food
- Prey form swarm through attraction, alignment and repulsion zones

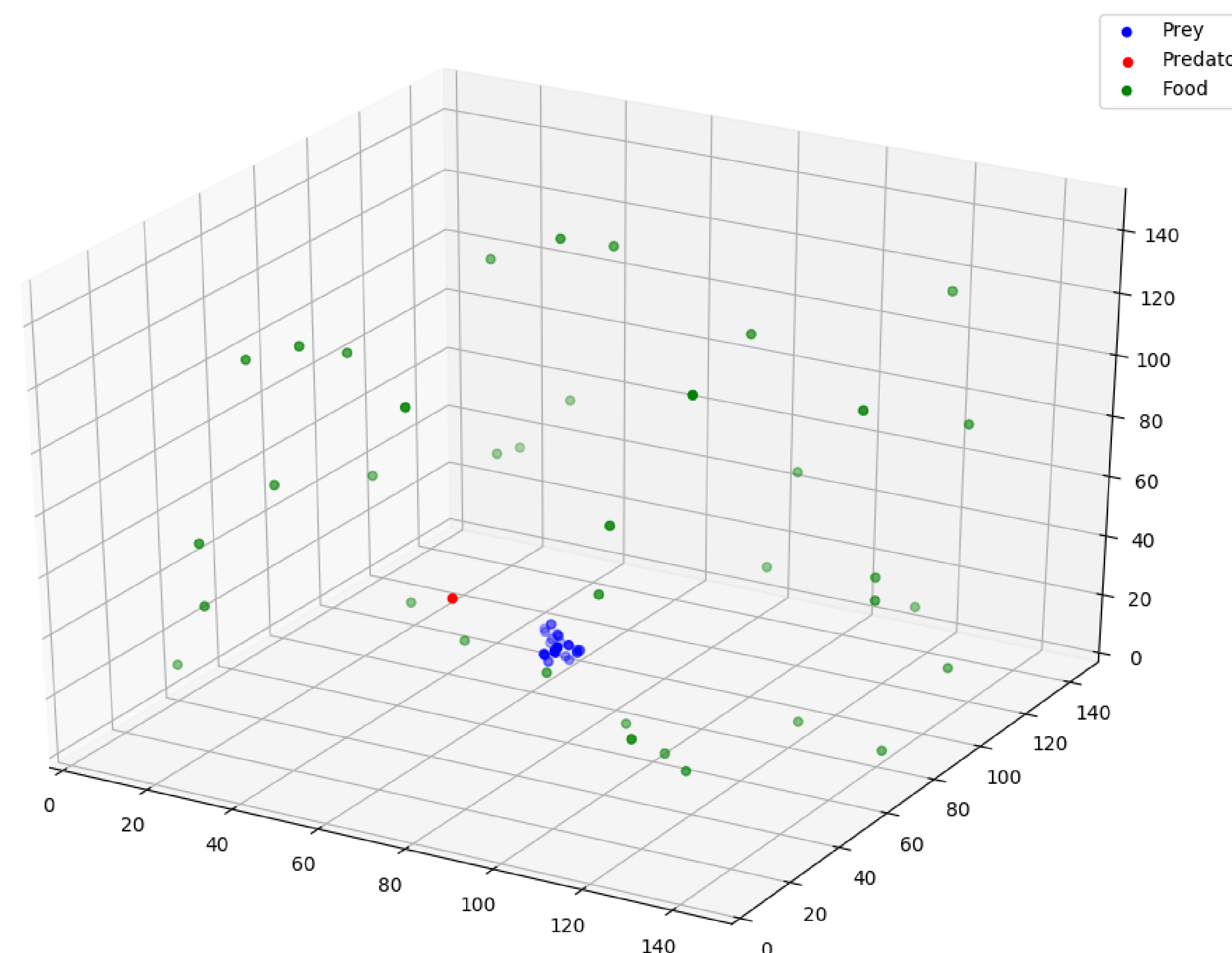


- Predators seek out a single prey
- A predator becomes confused by large groups of prey in the attack zone



MODEL: ENVIRONMENT

- Food is uniformly distributed in the outer half of the environment
- Environment is bounded



EVOLUTION

Fish that eat the most have a higher probability of creating offspring.

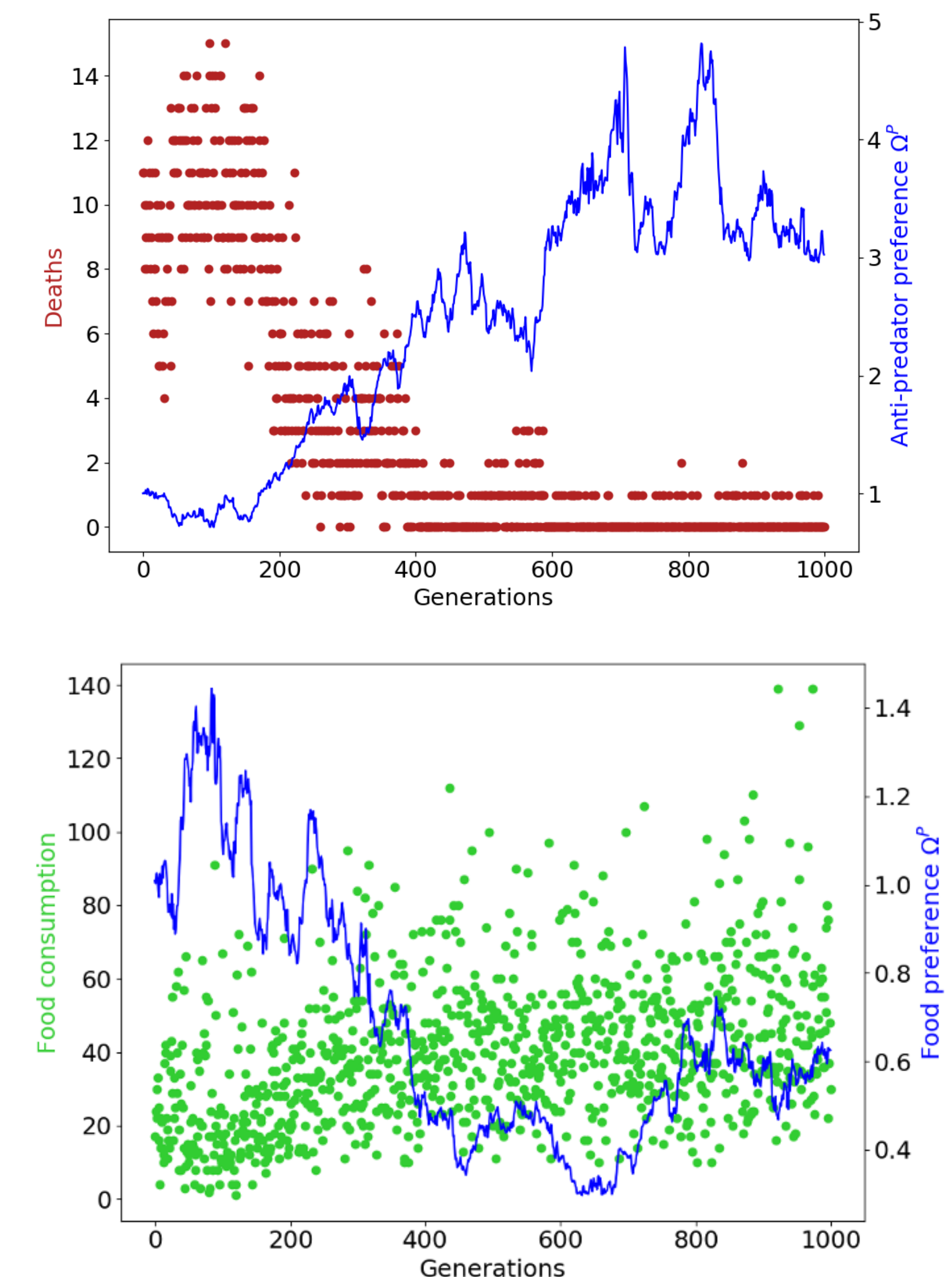
Prey

- Food preference
- Anti-predator preference
- Attraction preference

Predator

- Attack area

RESULTS



CONCLUSION

Despite many generations of evolution our model is incapable of maintaining the emergent behaviour present at the starting state of the model. However we can see in the results that the model is capable of correctly modeling some aspects of prey predator interactions.

REFERENCES

- Lett, Christophe et al. (2014). "Effects of successive predator attacks on prey aggregations". In: Theoretical Ecology 7.3, pp. 239–252.
- Wood, Andrew J and Graeme J Ackland (2007). "Evolving the selfish herd: emergence of distinct aggregating strategies in an individual-based model". In: Proceedings of the Royal Society of London B: Biological Sciences 274.1618, pp. 1637–1642.
- Zheng, M et al. (2005). "Behavior pattern (innate action) of individuals in fish schools generating efficient collective evasion from predation". In: Journal of theoretical biology 235.2, pp. 153–167.