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Side Blotched Lizards – Milestone 1

**Topic**

This project takes an in-depth look into the mating habits of Side Blotched Lizards from an evolutionary game theory perspective. The mating patterns will be simulated, then a time-series analysis will be performed to predict the future population.

**Business Problem**

The first business problem we will be exploring is understanding the mating patterns and cycles of Side Blotched Lizards. Can a reliable model be created that accurately simulates their real-life mating interactions? What assumptions must be made in order to do so? The second business problem will be to then use time-series analysis to detect patterns. How accurately can the model predict the outcomes of the simulation? How does population change over time? Can the model account for environmental constraints (limited availability of food, shelter, etc.)?

**Datasets**

The data will be entirely derived from the simulation. Each row will represent one single generation. It will contain information about the number of births, the proportion of the population that belongs to each color variation of lizard (orange, yellow or blue), and the birth rates for each variation. It will also contain a column that details the best mating strategy for each generation, which will be quantified by the variation that has the most successful births.

Since it is being simulated based on evolutionary principles, we have the freedom to simulate as many generations as necessary. Currently, the dataset has 1000 generations which seems to be enough for modelling and visualization. If more rows are necessary, I will be able to go back and rerun the simulation to create a larger dataset. The simulation function does require a few assumptions to make it work: each individual is a rational actor who is maximizing their own payoff, due to random mutation there is always a small chance of mutated genes, the male to female ratio is 1:1, and there is some form of environmental constraint limiting the population from increasing exponentially. These assumptions will be discussed in more detail in the white paper.

**Methods**

The simulation will be created by establishing a virtual environment where each actor makes one choice each generation, resulting in a number of offspring. These numbers come from a number of studies regarding their very unique mating habits (Sinervo, Nature). Each actor has a potential payoff of 0, 1, or 2 offspring depending on their choice to protect their mate, steal a mate, or add mates to their harem. The success of the strategy will be assessed by the proportion of each variation’s population. The proportion and population numbers will be updated for each generation, and then the cycle will continue.

Once we have the final dataset, it will be evaluated using time series analysis. I will create a time series model that attempts to find patterns in the mating cycles and can predict future mating cycles. This prediction will then be compared to the actual continued output of the simulation. It will be evaluated based on its ability to match the simulated data. This analysis will be used to further understand the underlying processes that drive the unique mating patterns of the Side Blotched Lizard.

**Ethical Considerations**

Since the data is exploring simulated lizard interactions, there is no danger or risk to parties having sensitive data exposed. That being said, there are other considerations we must make. The assumptions we are making are simplified compared to the intricacies of real life. For example, the environmental constraints are being quantified by simply having a population ceiling. In real life scenarios, there would be a lot more considerations involved in trying to determine how many lizards can comfortably live in an area. We must be upfront about the assumptions we are making so that we maintain that transparency with our audience.

**Challenges**

During the creation of the simulator, I ran into issues regarding runaway populations. This issue was solved by adding a fixed population ceiling, which is accurate to real-life environments. Each environment has different limiting factors that determine the population of a species that can comfortably live there, including food supply, shelter, predators, and territoriality (Edwards).

During the visualization process, I would like to attempt to create a time-lapse visualization of the populations. This is not something that I have experience with so I imagine it posing a bit of a challenge for me. I hope to use the skills that I have gained in the previous course on visualization to overcome those hurdles to create a solid, animated visualization.

References

Edwards, W. J. (n.d.). Nature news. https://www.nature.com/scitable/knowledge/library/population-limiting-factors-17059572/

*Networks*. Side Blotched Lizard and Evolutionary Game Theory : Networks Course blog for INFO 2040/CS 2850/Econ 2040/SOC 2090. (n.d.). https://blogs.cornell.edu/info2040/2016/11/26/side-blotched-lizard-and-evolutionary-game-theory/#:~:text=Under%20these%20conditions%2C%20the%20payoff,the%20payoffs%20of%20blue%20lizards

Sinervo, B., & Lively, C. M. (1996). The rock–paper–scissors game and the evolution of alternative male strategies. *Nature*, *380*(6571), 240–243. https://doi.org/10.1038/380240a0