Bacteria, Grazer, and Virus Persistence in a Predator-Prey Model

BOBBIE PATTON[1], Isha Tripathi[1], Aydin Karatas[1], Meena Khan, Ben Knowles[1,2]

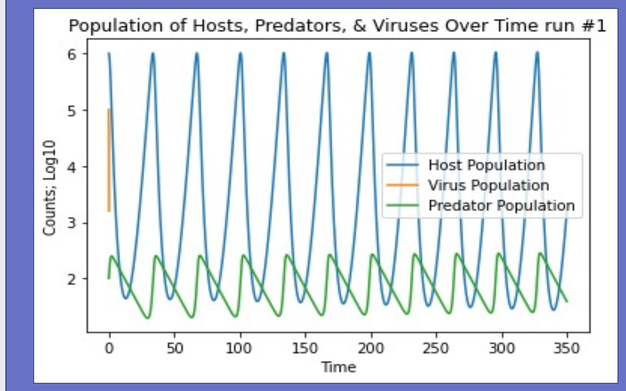
BIG Summer Program, Institute for Quantitative and Computational Biosciences, Department of Ecology and Evolutionary Biology, UCLA

Abstract

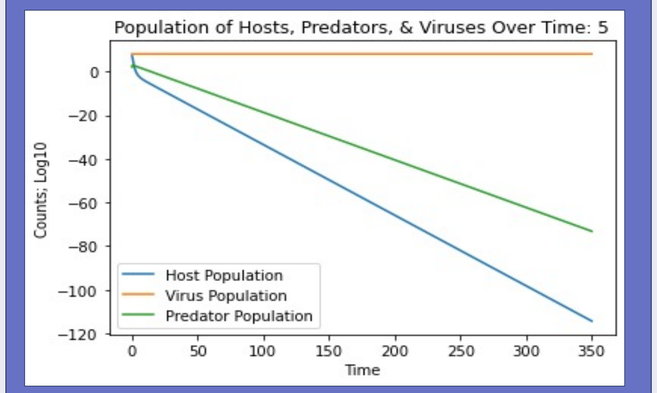
Microbes are usually killed by either viral infection or zooplankton grazing. However, few theoretical models incorporate viral as well as zooplankton mortality rates in environmental predation dynamics. To address this, we implemented a virus-host-grazer predator-prey theoretical model and determined how often the model led to the survival of these populations, and which parameters led to this outcome. We had expected to see virus, host, and grazer survival in models parameterized with reasonable initial values. Surprisingly, we observed pervasive population collapses under these conditions. As a result, we then sought to understand which parameters led to persistence. Doing so, we found only 186 out of 100,000 permutations with randomly chosen, reasonable parameter values survived 350 generations. Altogether, this suggests that either the theoretical model is overly constrictive, or populations must display highly specific traits in order to persist.

Background

Microbes in the ocean are killed by either viral infection or grazing.

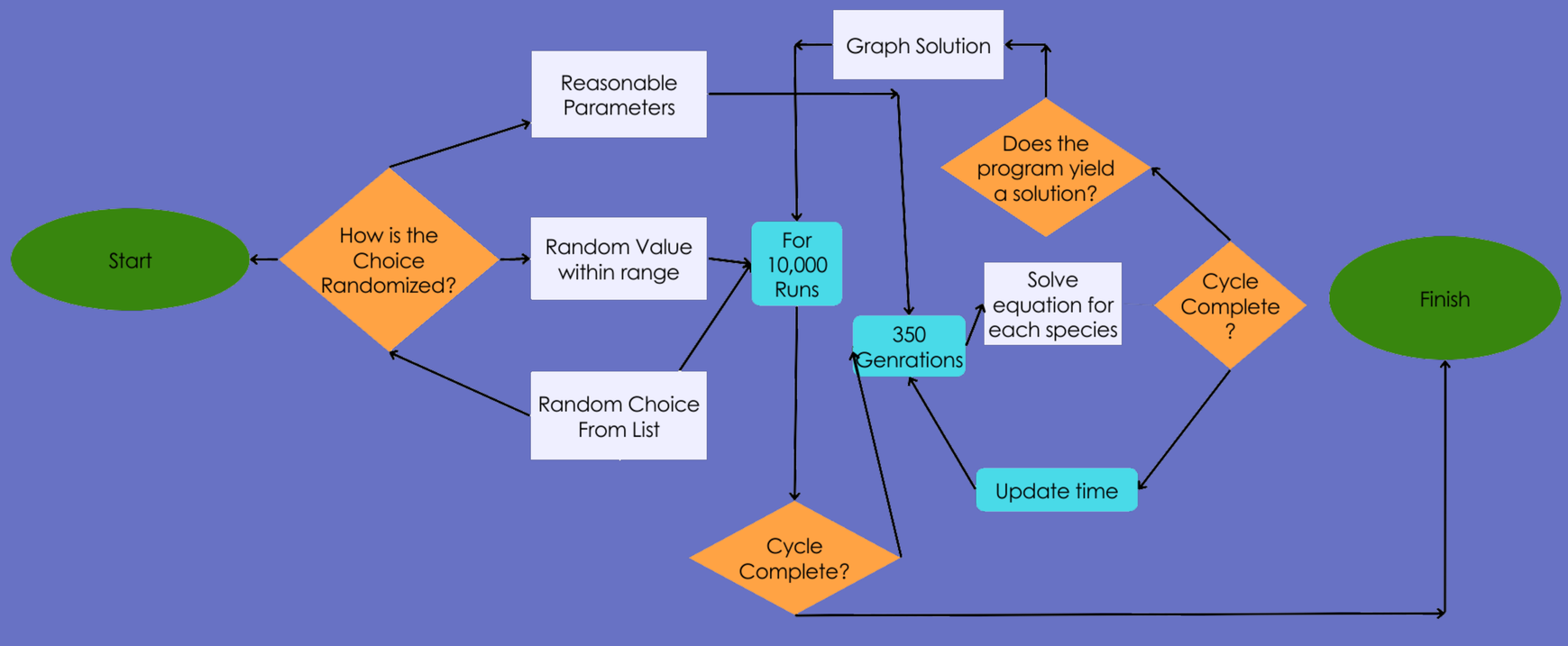


When testing reasonable parameters manually, the model could not sustain three populations at a time.



Even after manually finding solutions that worked, the model would often produce unreasonable results.

Methods



Results