# Agent Base Model for the locomotion and growth of a *S. Mediterranea* population in laboratory environment

Note: eventual update of the model can be found here:

https://github.com/Cyril-Basquin/Agent_Base_Model

INTRODUCTION

Schmidtea Mediterranea is a freshwater flatworm that glide on the substrate at a speed of about 1.5mm/sec. Basically, the worm is composed of three main parts: a head, a pharynx and a tail (see Figure). Planarians have amazing regeneration abilities and some of them as S. Med. took this ability as reproduction advantage. The reproduction of some strain of S. Med. occur exclusively through a scission mechanism. When a worm is big enough and in a good environment (quality of the water, not expose to intensive light, not too crowded.) the worm detaches its tail leading to the 'birth' of a new worm.
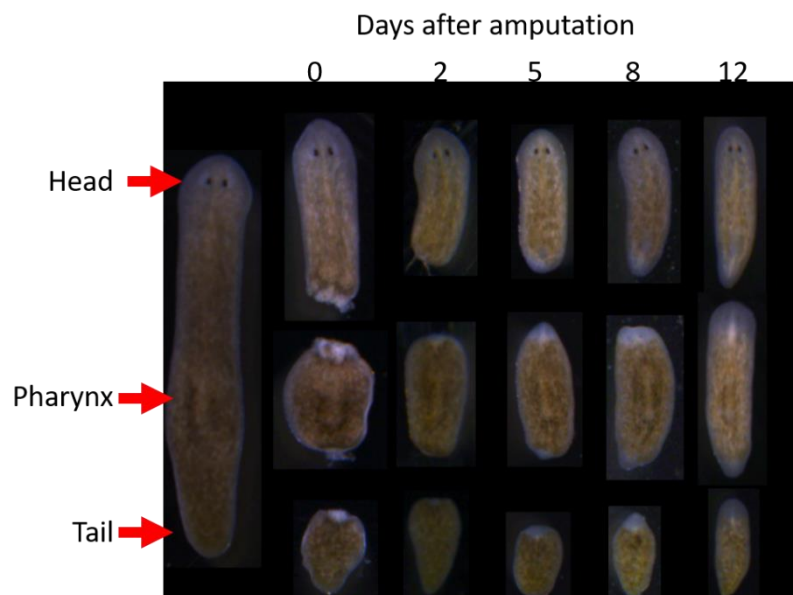
Then the 'mother' worm will just regrow its tail while the 'daughter' worm will regrow its pharynx and head. If you cut manually a worm in few pieces (with some limitation about the size of the pieces), you can regrow as many worms as pieces you cut (see figure). As consequence, there is no adult worm and child worm. As soon as they are healed, there are functional. The size of S. Med. is range between 0.2 mm up to 2cm.

QUESTION

Could cannibalism provide an advantage for the planarians?

METHODOLOGY & CONSIDERATION

The detail of all features is detailed in the 'info' part of the model

To put some limit to the tested parameters, I will consider some 'real' life approximation.

- 100 ticks = 1 week (real life)
  - Healing speed is consequently set to 90-150 ticks
  - Wash is set at 30 ticks which allows every worm to eat
- 200 energy = a 2 cm worms (1 = 0.01 cm)

A heterogenous initial population of 100worms was considered. Other parameters are set from my own experiences.

Flatworms can eat their fellows if they are hungry and the prey is much smaller than them.

TESTED PARAMETERS:

Cannibalism: ON/OFF

Feeding rate: 50 – 100 – 150 – 200 ticks

OUTPUT PARAMETERS:

Density (sum [energy] of flatworms)

Number of flatworms

RESULTS:

The figures below show the evolution of the number of the worm and the total size among time. The average of 10 runs is represented. As expected, a higher rate of feeding lead to faster increase of the worm numbers and size among time. Under the parameters of my model and experimental condition, cannibalism do not provide any advantage over a control population.

Evolution of flatworms number among time

Evolution of total flatwormssize among time
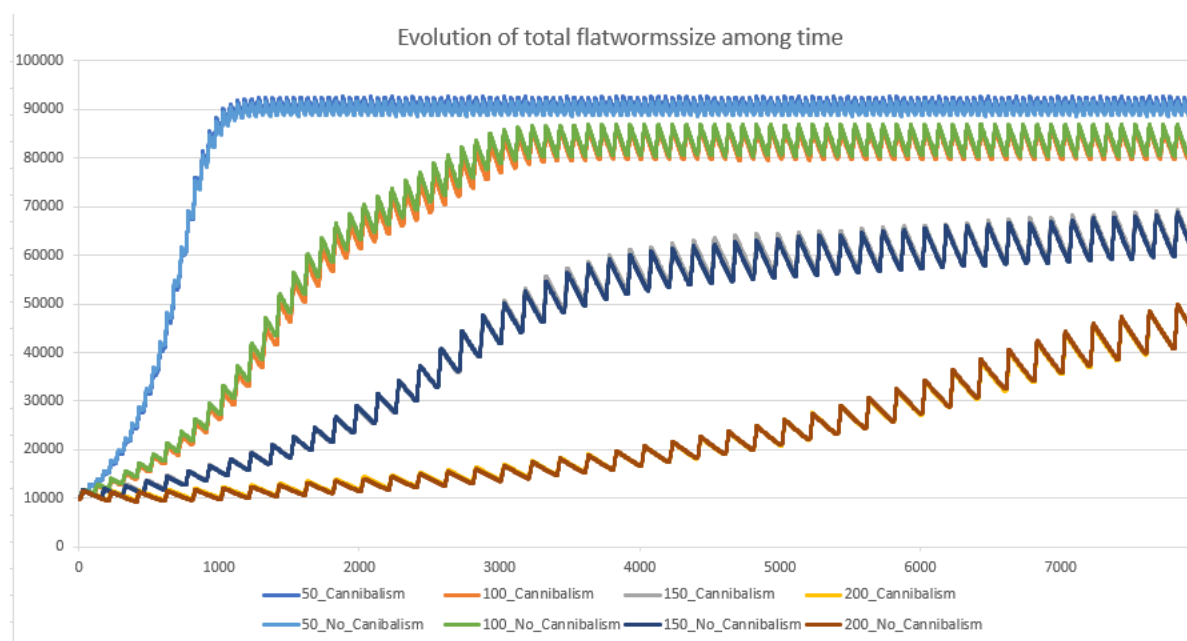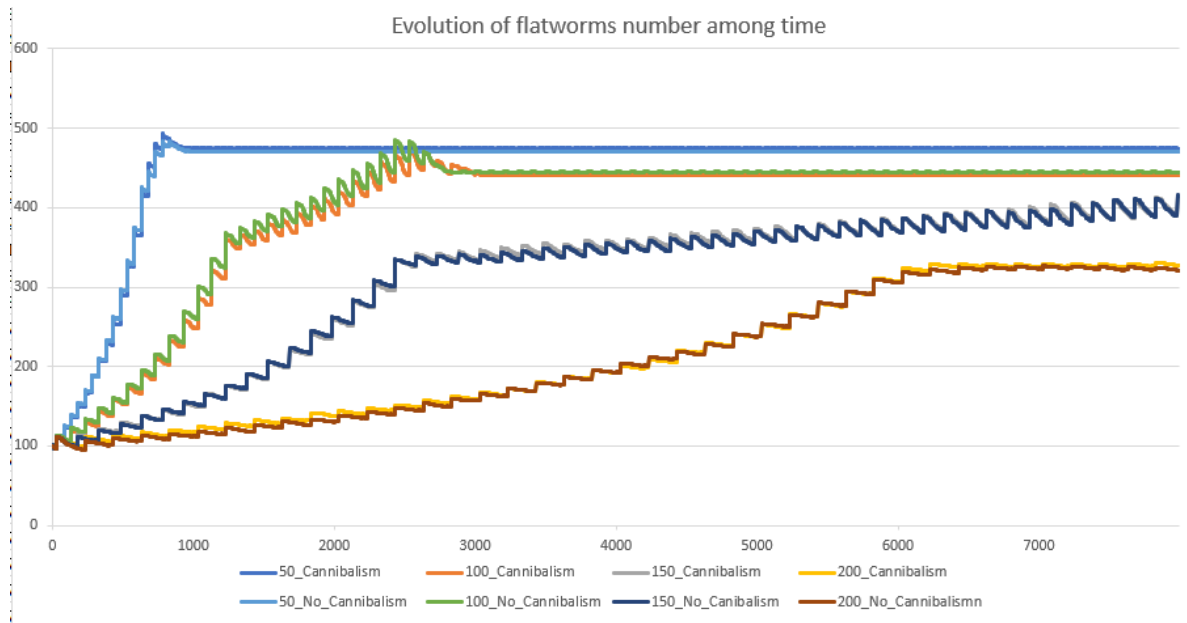
RESULTS:

Under my condition, I didn't find any advantage for cannibalism in *Schmidtea Mediterranea*. This is in accordance with millions of years of evolution... Which is reassuring.

Nevertheless, the experimental conditions that I setup provide a regular amount of food to the worms. In the future it could be interesting to test other condition such the effect of starvation on a *Schmidtea Mediterranea* colony.