1.8) THE POPULATION DYNAMICS OF PARAMECIA

Objective: In this laboratory exercise you will follow the rise and fall of a *Paramecium* population in real time.

Introduction: The term "Malthusian scenario" alludes to the pessimistic future predicted by Thomas Malthus in his famous treatise published during the early 18^{th} century. Even though Malthus acknowledged that technology had greatly elevated the quality of life for many people, he predicted that these gains would be offset by an increase in the population that would, in the long run, result in a never-ending struggle for resources.

Ironically, when Malthus formulated these ideas, both the population and the overall standard of living in Europe and the United States were rising at an unprecedented pace. This trend continued for about 150 years, thereby contradicting Malthus's assumption that population growth would always take place at the expense of living standards. Missing from his model was the vast potential of the energy resources beneath the surface of the Earth that fueled the Industrial Revolution. This in turn, resulting in a cultural shift towards smaller families as women started marring later in life.

Even though the worst consequences of resource depletion are often regarded as problems of the future, they have already been experienced by several pre-industrial societies of the past. In "Collapse: How Human Societies Choose to Fail or Succeed" *(1)*, Jared M. Diamond provides a meticulous account of human population were devasted after soils became too degraded as the result of deforestation.

Fossil fuels and technology have freed most of humanity from this struggle for basic survival, but they also enabled lifestyles that place enormous strains on the natural environment. Time will tell how all this will play out in the long run. In the meantime, studying lessons from past societies and protecting the soil can help humanity avoid the bleak outcome predicted by Thomas Malthus.

Literature Cited:

1. Diamond, J. 2005. Collapse: *How Human Societies Choose to Fail or Succeed.* Viking Press.

Procedure:

1) Start your culture by adding a dropperful of *Paramecium* culture to a 125-mL Erlenmeyer flask containing about 100 mL of culture media at room temperature.
2) Pick up the newly inoculated flask described the first step and swirl it so that you now have a uniform suspension (Fig. 1).
3) The next day, prepare a plastic Petri dish for counting by placing a tiny speck of iodine solution near the center of the plate. Use the glass rod or the application tool that comes with the solution and simply touch the plate as indicated (Fig. 2).
4) While it is swirling, insert the pipette and remove a dropperful from the center of the suspension and place a drop of the suspension on the Petri dish, making sure that it makes full contact with the iodine. *Warning: Do not touch the pipette to the Petri dish because this will contaminate the eyedropper with iodine and endanger the entire culture*! You have now "fixed" a sample of *Paramecium* for counting purposes.
5) Arrange the Petri dish with the fixed sample under a light microscope at about 40X (Fig. 3), so you can count all the paramecia in the drop. When you are done with the first count, wipe off the Petri dish and repeat the procedure (starting with the application of iodine) until you have at least 3 counting trials from the same flask. This is your "Day 1" reading.

Fig. 1

Fig. 2

Fig. 3

6) Count daily until population levels decrease to one or fewer individuals per drop. This may take from 30 to 60 days. Plug your data into a spreadsheet to calculate the daily average and standard error (see example below). Graph the data, placing the day on x-axis and the average on the y-axis.

◊	A	B	C	D	E	F
1	Day	Count 1	Count 2	Count 3	Average per drop	Standard error
2	1					

Questions:

1. What is the average number of organisms per drop when population levels are at their peak?
2. How long did it take for population levels to reach this peak and how long was it sustained?
3. How quickly did population levels collapse from peak levels to one animal or less per drop?
4. What is the overall shape of the graph?
5. Why did the population collapse?
6. List a condition that speeds up the rate at which the population rises and falls:

Assignment Checklist:

1. Did you completely answer all the questions?
2. Did you enter to a spreadsheet, calculate daily average, and make a graph?