In-class Assignment 02

According to the fisheries department, a fishpond may support 250 Tilapia fish per cubic meter of space. The Tilapia fish population (in thousands) in a pond owned by the business Bluewater Fishery for the year 2022 and 2023 is shown in the following table.

2022	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Population	0.3	0.36	0.44	0.54	0.66	0.80	0.98	1.18	1.44	1.74	2.11	2.54
2023	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Population	3.06	3.67	4.39	5.23	6.19	7.29	8.55	9.94	11.47	13.12	14.87	16.7

1. The chosen pond has a surface area of 100 square meters and a depth of 1.5 meters. Calculate the Carrying capacity of the pond.

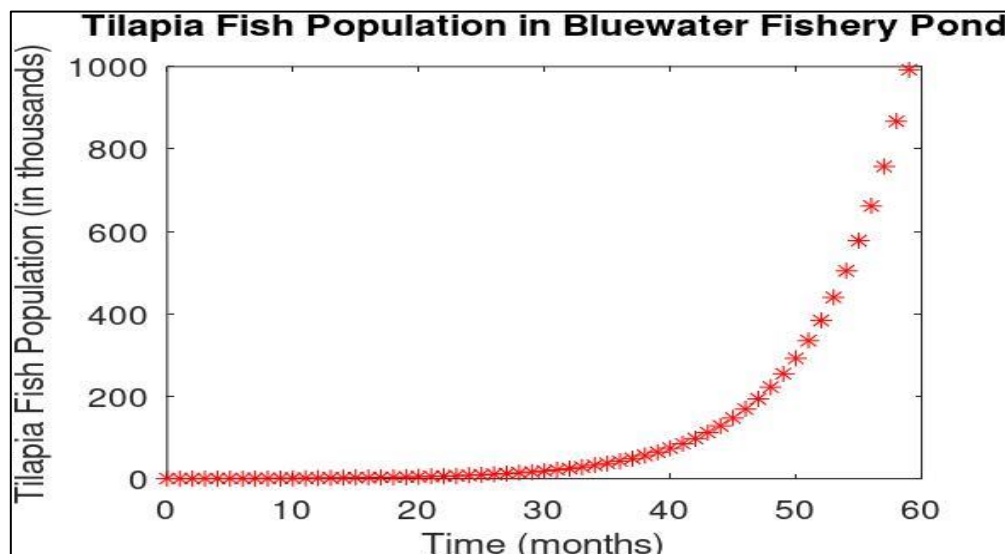   - Carrying capacity of the pond = 37500 Tilapia fish

2. Assume that the behavior of the population growth can be described by a discrete model, write down the model.

   - $a_{n+1} = a_n + r(37500 - a_n)a_n$

3. Taking intrinsic growth rate as r, find r using polyfit command.

   - r = 3.9385e-06

4. Plot the predicted population vs time up to December 2026. Insert your figure.

5. If the fraction of harvesting per month is 0.42 and the growth rate is 0.4 determine the population in the reservoir in June 2025 using the following model. [for your calculation use the same initial values]

   i. $\Delta P_n = rP_n\left(1 - \frac{P_n}{K}\right) - hP_n$ (Eq1)

   - population in the reservoir in June 2025 : 0.13102

6. Discuss the behavior of the population growth using the new model.
   - The new model, represented by Eq. 1, incorporates intrinsic growth, carrying capacity, and harvesting. The population tends to approach the carrying capacity, and harvesting influences the population dynamics. Observing the behavior involves analyzing how these factors interact and influence the population trajectory over time.

7. To increase profits, the company is supposed to maintain a fixed number of harvests per month rather than proportional harvesting (as in Eq. 1). What do you think about this?
   - Maintaining a fixed number of harvests per month can provide more stability to the harvesting process, but it may also lead to fluctuations in the population due to variations in growth rates. Proportional harvesting allows for adjustments based on the population size, which might be more sustainable. The decision depends on ecological considerations, economic goals, and the impact on the fish population and pond ecosystem. A careful balance between fixed and proportional harvesting is essential for sustainable and profitable fishery management.