

Individual Project 3

Model of Bird Population on Rügen Island

The population of rare birds on Rügen Island is modelled by the following equation:

$$\frac{dP}{dt} = r(M - P)(P - m),$$

where $P = P(t)$ is the number of birds, t is time in years, M is the maximum sustainable population, and m is the minimum population below which the species becomes extinct, r is a positive constant. The values of the maximum and minimum population are $M = 1200$, $m = 100$, and the value of the constant r is 0.001.

Questions:

- a) Show that the differential equation can be rewritten in the form

$$\left[\frac{1}{1200 - P} + \frac{1}{P - 100} \right] dP = 1.1 dt$$

and solve this equation with pen and paper.

- b) How many birds will be in 5 years if there are 300 birds now?
- c) Use Matlab to find the solution of the differential equation with the initial condition $P(0) = 300$ analytically (dsolve) and numerically (ode45). Plot the graph of the solution.
- d) Estimate from the graph when the rate at which the bird population changes is highest.