

Math 354, Class Exercise 2
Density Dependent Growth Class Exercise
Instructor: Dr. Fred Park

1. F.E. Smith suggested a different model for the population growth of a species limited by the food supply based on experiments on a type of water bug. As in the logistic model, the growth rate is proportional to the difference between the available food f_a and the subsistence level of food consumption f_c :

$$\frac{1}{N} \frac{dN}{dt} = \alpha(f_a - f_c)$$

However, previously f_c was assumed proportional to the number of individuals of the species. Smith instead assumed that more food is necessary for survival during the growing phase of the population. Thus, a simple model would be:

$$f_c = \beta N + \gamma \frac{dN}{dt}$$

with $\alpha > 0$. What differential equation describes this model? What are the equilibrium populations? Are the equilibrium populations stable? How would you show this?

2. Can you find an explicit solution of the logistic equation?

$$\frac{dN}{dt} = N(a - bN)$$