Logistic Population Growth and Harvesting

Math 165
Spring 2009

In this project, you and your partner will use the excel spreadsheet named Harvested Population Growth to explore the populations.

Download the Harvested Population Growth file from the course webpage
http://www.math.pacificu.edu/~boardman

Use this spreadsheet for each of the following questions. Answer each question carefully and fully in a Microsoft word document. For each problem, copy and paste the graph produced in the spreadsheet to your word document, but shrink this graph to be smaller. Be sure to include both partners' names. Print the final report and hand it in by the final, **Friday May 15**.

1) Suppose that there are 5000 elk in Western Montana. Also assume that the maximum number of elk that could be sustained in this region is 10,000 (based on environment and predation) and that the natural growth rate for the elk is 3% per year.
    a. Under each of the separate conditions below, determine if the population survives. If so, determine the limiting population. If it does not survive, how long does it take for the population to die off. Include graphs in your answers (make them smaller on the page)
        i. Elk are not allowed to be hunted.
        ii. Elk can be hunted and the state allows up to 100 elk to be killed per year.
        iii. Elk can be hunted and the state allows up to 90 elk to be killed per year.
        iv. Elk can be hunted and the state allows up to 50 elk to be killed per year.
    b. Determine the theoretical maximal sustainable annual harvest of elk under these parameters.
2) Assume there are 100,000 salmon in a region in the Pacific Northwest. Also assume that a population of 150,000 is sustainable in this region. The salmon population naturally grows at a rate of 3.5%. Determine the maximum sustainable annual harvest of this salmon population.
3) Suppose that river conditions change and that the environment can now only sustain 50,000 salmon (even though there are currently 100,000).
    a. Entering a harvest of 0, what happens to the population of salmon over time.
    b. What happens with the population if the natural growth rate of the salmon is 5% rather than 3.5%.
    c. Experiment with various parameters for growth rate and harvest and comment on the result.