Ecology, BI 325 Name_____
Fall 2007

Homework 1 - Life tables and population growth

This is due in lecture on Wednesday, Oct. 17. You can work together and discuss these exercises, but if you do, be sure that you know how to do the required manipulations; there is a fairly high probability that a similar question will appear on the midterm or on the final.

1) (7 pts) From the data shown below, complete the cohort life table below and calculate the net reproductive rate (R_o), the generation time (T_g), and the intrinsic rate of increase (r).

Age in yrs	N_x	m_x	s_x	l_x	l_xm_x	x l_xm_x
0	2000	0.0				
1	750	0.0				
2	300	3.2				
3	100	4.0				
4	50	5.2				
5	40	4.5				
6	8	2.7				
7	0	0				

In addition to filling the spaces below, INCLUDE UNITS FOR EACH VALUE, and SHOW YOUR WORK for how you obtained the following parameters:

R_o = _____

T_g = _____

r = _____

2) (1 pt) Is this population growing or declining? What is the basis for your conclusion?

3) (4 pts) As a wildlife manager assigned to work with the species for which this life table was built, you must decide between two management procedures to maximize the population's growth rate. Option A increases the mean fecundity of two year olds (m_2) from 3.2 to 4.2. Option B increases the mean fecundity of four year olds (m_4) from 5.2 to 7.2. Use life table calculations to determine the effects of each option on the growth rate of this population, and then answer the following questions:

a) Which option would have the greatest effect?
b) What do you think is the best biological explanation for the difference in the effects of these two options?

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4) (4 pts) The following are estimates of the world population of humans, spanning the last 2007 years:

Year	Population (in billions)
0	0.30
1000	0.31
1250	0.40
1500	0.50
1750	0.79
1800	0.98
1850	1.26
1900	1.65
1910	1.75
1920	1.86
1930	2.07
1940	2.30
1950	2.52
1960	3.02
1970	3.70
1980	4.45
1990	5.30
1994	5.63
1999	6.00
2007	6.62

Use the exponential growth equation to calculate r (the per capita rate of increase) for the human population during the following time intervals: a) from 0 to 1000, b) from 1000 to 1900, c) from 1990 to 1999, and d) from 1999 to 2007. (Hint: to calculate r, first rearrange the exponential growth equation by setting r on one side of the equation, and all other variables on the other side. To do this, it will help to remember that for any value (x), the following statement is true: $\ln(e^x) = x$).

During which period is r greatest? Show your work.

5) (1 pt) Based on your answers to part a, is there any evidence that human population growth is slowing down? Explain.

6) (3 pts) It has been estimated by some researchers that by the year 2050, there will be approximately 9 billion people on earth. Using your estimate of r from the 1999-2007 period above, estimate the projected human population size in the year 2050, assuming that the current population continues to grow at the rate it grew from 1999 to 2007. What is the likely explanation for the difference between your estimate and the estimate of 9 billion that researchers have produced?