**Population Growth Rate Problems**

Use the formulas in the box below to try and solve the problems.

|  |  |
| --- | --- |
| **Birth rate**: b=B/N **Death rate**: m=D/N **Individual or Population Growth Rate** (per capita): r=(B-D)/N or r = b-m **Population Growth :** N1=N0 + r(N0)**Exponential Growth Rate Calculation**: ΔN/Δt=rmaxN **Logistic Growth Rate Calculation**: ΔN/Δt=r max N[(K-N)/K]  | t=timeB=births during timeb=birth rateD=deaths during timem=death rateN=population sizeΔN/Δt =change in population #’s over time K=carrying capacityrmax=maximum per capita growth rate of population  |

**Population Density Problems:**

Example: If 300 blue jays are found in a 20 hectare plot, what is the density in blue jays/hectare in that plot? Round to the nearest whole number

300/20 = 15 blue jays/hectare

1. If 3400 maple trees are counted on a 3km x 4km rectangular patch of land, what is the density of maple trees per square kilometer? Round your answer to the nearest tenth.

3x4=12km2 3400/12=**283.3 trees/km2**

1. Suppose the population density of a sample of deer is 50 per square kilometer. Assuming that the population is uniformly distributed, what would the population size be if the deer encompassed an area that was 20km x 200km? Round your answer to the nearest whole number.

50/km2  20x200=4000km2 x 50/km2=**200,000 deer**

**Population Growth Problems:**

1. There are 252 deer in a population. There is no net immigration or emigration. If 47 deer die and 32 deer are

born in one month, what is the population size at the end of the month? Round your answer to the nearest whole number.

 252 – 47 + 32 = **237 deer**

|  |  |  |
| --- | --- | --- |
| **Female** | **Alive at end of year?** | **Offspring** |
| 1 | yes | 1 |
| 2 | yes | 1 |
| 3 | yes | 0 |
| 4 | no | 0 |
| 5 | yes | 1 |
| 6 | yes | 0 |
| 7 | no | 0 |
| 8 | yes | 1 |
| 9 | yes | 0 |
| 10 | yes | 1 |

1. A rancher is thinking of shifting his population from cattle to bison. He buys 10 inseminated female bison and puts them each in their own pasture to see how well they do. To the right is a table summarizing his findings after one year.

a. What is the total # of deaths and births?

**B=5 D=2**

b. What is the average estimated per capita birth and death rates in the population (*b* and *m*)?

 b=B = 5 = .5 m=D = 2 = .**2**

 N 10 N 10

1. What is the per capita growth rate, *r*?

R= (B-D) = (5-2) = 3 = .**3**

 N 10 10

1. Based on these estimates, what is the rancher’s population at the end of the year?

N1 = N0 + r (N0)

 N1 = 10 + .3 (10) = 10 + 3 = **13**

Example problem:

In a population of 600 squirrels, the per capita birth rate in a particular period is 0.06 and the per capita death rate is 0.12.

1. What is the per capita growth rate of the population? Round your answer to the nearest hundredth.

*R = 0.06 – 0.12 = -0.06*

1. What is the actual number of squirrels that die during this particular period? Round your answer to the nearest whole number.

*D = 600 x 0.12 = 72 deaths*

1. What is the actual number of squirrels that are born during this period? Round your answer to the nearest whole number.

*B = 600 x 0.06 = 36 births*

1. In a population of 750 fish, 25 die on a particular day while 12 were born. [N=75-, D=25, B=12]

a. What is the per capita death rate for the day? Round your answer to the nearest thousandth.

 M = D/N m = 25/750 **m = .033**

b. What is the per capita birth rate for the day? Round your answer to the nearest thousandth.

 B = B/N b = 12/750 **b = .016**

c. What is the per capita rate of increase for the day? Round your answer to the nearest thousandth.

R = b – m r = .016 - .033 = **-.017**

1. In a population of stinkbugs, you estimate the population is 3000. Over the course of month, you record 400 births and 150 deaths. Estimate r and calculate what the population would be predicted to be in 2 months

R = growth rate = R= (B-D) = (400-150) = .083/month

 N 3000

N1 = N0 + r (N0 ) = 3000 + .083(3000) = 3000 + 250 = 3250 after one month = N1

N2 = N1 + r (N1) = 3250 + .083(3250) = 3250 + 270.8 = **3520.8 after 2 months**

1. In June of 2015 you are trying to estimate the size of the coyote population in the Taconics. You mark 30 coyotes, release them, and go back and recapture 100 coyotes, 10 of which are marked. Using the formula below, estimate the size of the population.

*N=Mn* N = (30)(100) = 300

 *M 10*

*N*=population to be estimated

*M*=initially tagged

*n*=recaptured individuals

*m*=# of marked in the recapture