Introduction to Populations - Worksheet

1. If an aquarium holds 80 L of water and contains 170 guppies, what is the approximate density of the guppy populations?
   a) 1 guppy / L
   b) 2 guppies / L
   c) 3 guppies / L
   d) 4 guppies / L

2. If 300 blue jays are found in a 20 hectare plot, what is the density in blue jays/hectare of that plot?
   a) 0.07
   b) 15
   c) 20
   d) 600

3. If 3400 maple trees are counted in a 3 km x 4 km rectangular patch of land, what is the density of maple trees per square kilometer?
   a) 283
   b) 1133
   c) 850
   d) 3400

4. Suppose the population density of 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 20 km x 200 km?
   a) 80
   b) 100
   c) 1000
   d) 200,000

5. Which is a density-independent factor?
   a) an intestinal parasite
   b) severe overcrowding
   c) a severe flood
   d) a fatal virus

6. Which limiting factor is dependent on the density of the population?
   a) dumping of toxic waste in a river
   b) contagious bacterial infection
   c) wide-spread drought
   d) forest fire

7. Match each description with the expected type of spatial distribution, where a = clumped, b = uniform, and c = random.
   a herding animals
   b territorial black bears
   a fish that form schools
   c mushrooms in a forest
   a birds that flock together
   c dandelions in a lawn

8. There are 252 deer in a population. There is no net immigration or emigration. If 32 deer die and 47 deer are born in one month, what is the population size at the end of the month?
   a) 15
   b) 252
   c) 267
   d) 331

9. There are 2,000 mice living in a field. If a 1,000 mice are born each month and 200 mice die each month, what would be the change in population over one year?
   a) 800
   b) 7600
   c) 9600
   d) 11,600

10. There are 19 frogs living in a swamp. In June, 2 frogs immigrate into the swamp while 3 frogs die due to predation. In July, 6 more frogs have been lost to predators and 2 have emigrated. How many frogs live in the swamp in August?
    a) 9
    b) 10
    c) 13
    d) 24

Key

Working Towards Mastering the I Can Statements—Practice

1. Read each situation in the chart below. Then, state if it is a density-independent limiting factor or a density-dependent limiting factor. Then, state the specific limiting factor that is occurring. The first one is done for you as an example.

Situation	Density-independent, or density-dependent?	Limiting Factor:
Mrs. Engelbrecht has 32 students assigned to her Biology class, but she only has room for 28. Because the room is so crowded, the extra 4 students leave the room to go to Guidance and have their schedules changed.	density-dependent	emigration
Northern pike (it's a fish) feed on another fish, the yellow perch. An increase in the yellow perch population causes an increase in the northern pike population.	D-D	predation
The BP oil spill in the Gulf of Mexico has harmed many aquatic organisms that live in the Gulf region.	D-I	human activity
A new strain of influenza (the flu) breaks out in New York City.	D-D	disease
A population of rabbits and a population of deer are both feeding off the same plants in the same habitat.	D-D	competition
Hurricane Katrina forced thousands of people to leave New Orleans.	D-I	natural disaster
65 million years ago, a large asteroid collided with the Earth. As a result, large amounts of ash were ejected into Earth's atmosphere.	D-I	natural disaster
Due to humans putting increasing amount of greenhouse gases into the atmosphere and cutting down trees that would normally take up some of those gases, the Earth slowly gets warmer and changes climates around the globe.	D-I	human activity

Pop. Density = # of Individuals / unit area Pop. Change = (B-D) + (I-E)

Rate of Change = Δ Density / Δ Time Pop. Growth Rate = Pop. Change / Initial Pop x 100%

SNC2D

Population Problems

Name: Key

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1. A biologist studied a population of box turtles in a wood lot for a period of 10 years. The average natality was 40 per year. The mortality was 30 per year. Immigration was 3 turtles per year, while emigration was 8 per year.

   (a) Was the population increasing or decreasing?
   (b) What was the net gain or loss of turtles per year? 43 - 38 = +5
   (c) If the original turtle population in the wood lot was 23 turtles, what was the population after 10 years? (10 x 5) + 23 = 50 + 23 = 73

   d) Pop Growth Rate per year: 5/23 x 100 = 21.7% ≈ 22%/year

2. On Sept. 10, 1989, biologists measured the squirrel population in a 20 hectare area. It was found that there were 84 squirrels. Two months later, on Nov. 10, the count in the same area was 50 squirrels.

   Sept: 84/20 = 4.2 squirrels/ha Nov: 50/20 = 2.5

   (a) Calculate the population density of squirrels (number per hectare)
   (b) Give 3 reasons why the population apparently declined in this two month period. - hibernation, lack of food, predators

   c) Rate of change

3. On a range of 1400 hectares, there is a population of 1280 rabbits. Studies show the following rates for this population:

Natality	-- 2220 per year
Mortality	-- 1130 per year
Immigration	-- 200 per year
Emigration	-- 430 per year

   2420 - 1560

   (a) Is the population increasing or decreasing? 2420 - 1560 = 860
   (b) How much is the population changing each year?
   (c) What will the population be at the end of 4 years, if all rates shown above remain the same? (860 x 4) + 1280 = 4720
   (d) What will the population density be at the end of 4 years? 4720 / 1400 = 3.4

   Growth Rate: 860/1280 x 100 = 67%

4. In a 25 hectare field in 1980, it was estimated that there was a total of 45 000 grasshoppers. Over a 8 year period, the following average rates of population change were found:

Natality	-- 11 000 per year
Mortality	-- 7 500 per year
Immigration	-- 9 000 per year
Emigration	-- 2 500 per year

   } 10,000 hoppers/year

   (a) What was the grasshopper population density in 1980? 45000/25 = 1800 hoppers/ha²
   (b) What was the population at the end of 8 years? 10,000 x 8 = 80,000 + 45000 = 125 000
   (c) What was the population density at the end of 8 years? 125000/25 = 5000/ha
   (d) What was likely to happen to the producers in this area over the 8 year period? Why?

   decrease ↑ # of grasshoppers due to less food

   e) Calculate the Rate of Density Change

   $\frac{\Delta D}{\Delta T} = \frac{5000 - 1800}{8} = \frac{3200}{8} = 400$ hoppers/ha²/year