Answers to p. 310 #3-9

3. How can knowing the size of a wolf population be useful?

Answers will vary. Example: It can tell us whether the population is healthy or in decline, which will affect other species in the same environment.

4. For each of the following examples, name the factor that makes the population size vary (births, deaths, immigration or emigration) and specify its effect.

a) Every spring, Canada geese return to the shores of Lac Tranquille.

b) During a logging operation, the noise from the forestry vehicles scared away the white-tailed deer in the vicinity.

c) In the spring, a female bear nurses her three cubs in her den.

d) Fish farmers stock a river with salmon fry.

e) Cottage owners can eliminate voles by installing traps in the roof.

Write your answers in the table below.

Example	Factor	Effect on population size
a)	*Immigration*	*Increase*
b)	*Emigration*	*Decrease*
c)	*Birth*	*Increase*
d)	*Immigration*	*Increase*
e)	*Death*	*Decrease*

5. What happens to a population when death and emigration rates are higher than birth and immigration rates?

The size of the population decreases.

6. The photos below show a slug (A), an American robin (B) and a bison (C). What would be the most appropriate method for measuring the size of a population of each of these species?

A. *Counting by sample area*

B. *Mark and recapture*

C. *Counting by individuals*

7. Scientists want to determine the size of a population of brook trout in a lake. First, they catch 50 trout, tag them and release them. A few days later, they catch 55 trout, including 11 tagged fish.

a) Which method for measuring population size did the scientists use?

Mark and recapture

b) What is the estimated population of brook trout in this lake? Show your calculations.

$$\text{Population size} = \frac{\text{Number of marked fish} \times \text{Total number of fish captured the second time}}{\text{Number of marked fish recaptured}}$$

$$\text{Population size} = \frac{50 \times 55}{11} = 250 \text{ individuals}$$

8. The twelve-spotted lady beetle feeds on the eggs of the Colorado potato beetle (a pest that attacks potato plants).

Biologists wanted to study the population of this type of lady beetle in a potato field of 10 000 m^2, so they counted the number of individuals in one-square-metre quadrats. The table on the following page presents the results of this sampling.

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Quadrat number	Number of twelve-spotted lady beetles	Quadrat number	Number of twelve-spotted lady beetles
1	2	6	0
2	1	7	0
3	0	8	1
4	1	9	1
5	0	10	0

a) What is the size of the population of twelve-spotted lady beetles in the field under study? Show your calculations.

$$\text{Population size} = \frac{\text{Average number of individuals per section} \times \text{Total study area}}{\text{Area of a section}}$$

$$\text{Average number of individuals per section} = \frac{2+1+0+1+0+0+0+1+1+0}{10} = 0.6 \text{ individuals per section}$$

$$\text{Population size} = \frac{0.6 \times 10\,000}{1} = 6\,000 \text{ individuals}$$

b) What is the population density of twelve-spotted lady beetles in the field under study? Show your calculations.

$$\text{Population density} = \frac{\text{Number of individuals}}{\text{Space occupied}}$$

$$\text{Population density} = \frac{6\,000}{10\,000} = 0.6 \text{ individuals per } m^2$$

c) If the population of twelve-spotted lady beetles were higher than the Colorado potato beetle population, what would happen?

The size of the Colorado potato beetle population would decrease, but eventually so would the lady beetle population, from lack of food.

9. The table below contains statistics on the human population and the area of Canadian provinces and territories (according to Statistics Canada, April 1, 2007).

Province or territory	Population	Total area (km^2)	*Population density (per km^2)*
Nfld.	506 548	405 212	*1.3*
P.E.I.	138 800	5 660	*24.5*
N.S.	932 966	55 284	*16.9*
N.B.	748 878	72 908	*10.3*
Québec	7 687 068	1 542 056	*5.0*
Ontario	12 753 702	1 076 395	*11.8*
Manitoba	1 182 921	647 797	*1.8*

Saskatchewan →	990 212	651 036	*1.5*
Alberta	3 455 062	661 848	*5.2*
B.C.	4 352 798	944 735	*4.6*
Yukon	30 883	482 443	*0.06*
N.W.T.	41 795	1 346 106	*0.03*
Nunavut	31 216	2 093 190	*0.01*

a) In which province or territory is the population density the lowest?

Nunavut

b) In which province or territory is the population density the highest?

Prince Edward Island

c) How does Québec rank in population density compared to the other provinces and territories?

It ranks sixth.