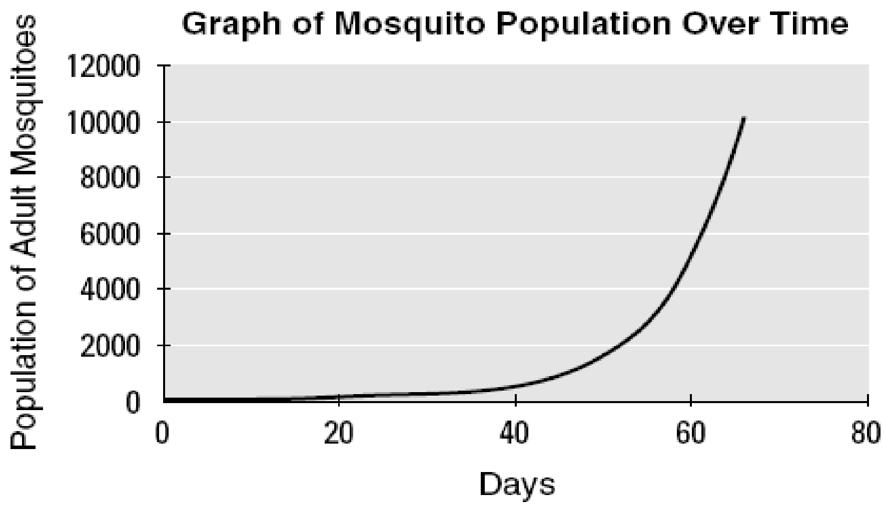
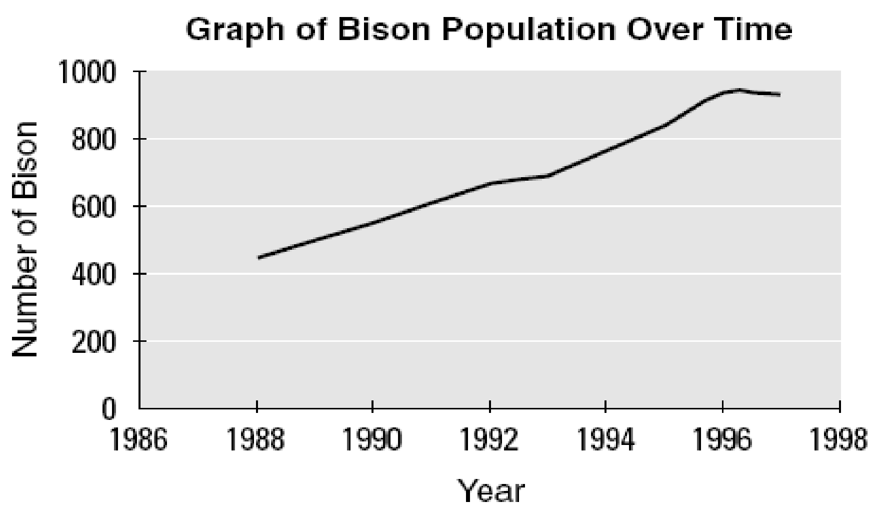
CHAPTER 20		BLM 20.0.1A
ANSWER KEY	**Launch Lab: Reproductive Strategies and Population Growth Answer Key**	

Procedure

Your graph should reflect the following:



Growth of *Aedes* mosquito population over one growing season.



Growth of plains bison (*Bison bison*, subspecies *bison*) population of Pink Mountain, British Columbia.

Answers to Analysis Questions

1. The graph of the growth of the mosquito population is a steeply rising curve, showing that the population grew quickly over a single growing season. The graph of the plains bison population shows that the population grew slowly but steadily until 1996 and then leveled off.

Launch Lab: Reproductive Strategies and Population Growth Answer Key (cont'd)

2. A reasonable hypothesis would be that because of the bison's reproductive strategies (long reproductive cycle and few offspring), its population grew relatively slowly. Perhaps because of limited resources, the bison population reached a maximum of 934 individuals. It would be reasonable to predict that the bison population would remain at about 930 individuals through to 2007 (a horizontal line on the graph) because of limited resources or some other environmental factor. A reasonable hypothesis would be that the reproductive strategies of the *Aedes* mosquito (short reproductive cycle and numerous offspring) caused its population to explode when conditions were favourable for growth. It would be reasonable to predict that the number of adult mosquitoes would crash with the onset of fall, since the adults cannot survive in cold weather.

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CHAPTER 20 ANSWER KEY	Patterns of Population Distribution Answer Key	BLM 20.1.1A

1. The distribution pattern of Population A is random.

   The habitat of Population A is likely to be characterized by abundant resources throughout.

   Members of Population A are likely to be distributed in no discernible pattern. Members do not have to compete with each other for resources, nor do they need to group together for survival.

The distribution pattern of Population B is clumped.

The habitat of Population B is likely to be characterized by specific areas where resources, such as food, water, or shelter, are abundant. In other words, resources are unevenly distributed throughout the habitat.

Members of Population B are likely to be competing for resources, although they may need to group together for protection from predators or in order to reproduce.

The distribution pattern of Population C is uniform.

The habitat of Population C is likely to be artificially controlled, like that of an orchard, or it could be characterized by a uniform distribution of resources.

If the population is not being artificially controlled, members of Population C are likely to be territorial and liable to fiercely defend resources and young against any competitors thought to threaten either one.

CHAPTER 20		BLM 20.1.2A
ANSWER KEY	**Thought Lab 20.1: Distribution Patterns and Population Size Estimates Answer Key**	

Answers to Procedure Questions

1. Distribution #1 is random, and Distribution # 2 and #3 are clumped.

2. Area per transect is (9.3 km)(0.7 km) = 6.5 km^2.

3. Distribution # 1 has 6, 5, and 3 moose per/transect.
Distribution # 2 has 9, 5, and 8 moose/transect.

Distribution # 3 has 9, 20, 5, 14, 8, and 3 moose/transect.

4. Distribution # 1 averages 4.7 moose/transect.
Distribution # 2 averages 7.3 moose/transect.
Distribution # 3 averages 9.8 moose/transect.

5. For Distribution #1: density = 4.7 moose/6.5 km^2 = 0.72 moose/km^2
For Distribution # 2: density = 7.3 moose/6.5 km^2 = 1.1 moose/km^2
For Distribution # 3: density = 9.8 moose/6.5 km^2 = 1.5 moose/km^2

6. Area of study = (9.3 km)(9.3 km) = 86.5 km^2
Population size of Distribution #1 = (0.72 moose/km^2)(86.5 m^2) = 62 moose
Population size of Distribution #2 = (1.1 moose/km^2)(86.5 km^2) = 95 moose
Population size of Distribution #3 = (1.5 moose/km^2)(86.5 km^2) = 129 moose

Answers to Analysis Questions

1. For Distribution # 1: 62 – 60 = 2
For Distribution # 2: 95 – 133 = –38
For Distribution # 3: 129 – 133 = –4

2. For the first population, there was very little difference between the estimate and the size of the actual population.

3. The estimate for the second population is off because the population was clumped and the samples were all taken in the less populated areas. More samples were taken with the third population and the estimate was more accurate as a result. Some of these samples included large numbers that represented the clumped distribution of the population. These samples were not taken in the second population.

4. The sampling technique could involve sampling a moose population in a more limited area, such as a small field or small wooded area, and using random capture, such as quadrant and transect techniques. With small areas, an actual census can be conducted and the results compared to the two estimation techniques to evaluate them.

Answer to Extension Question

5. Scientists could use the density to determine the actual size of a population. If it is too large and there's fear of going above the carrying capacity of the environment, they could inform government sources that grant hunting licenses. More hunting would be permitted to regulate the size of the population. Given the size of this population, you could determine its density by dividing the population size by the area of the range over which this population is found.

CHAPTER 20

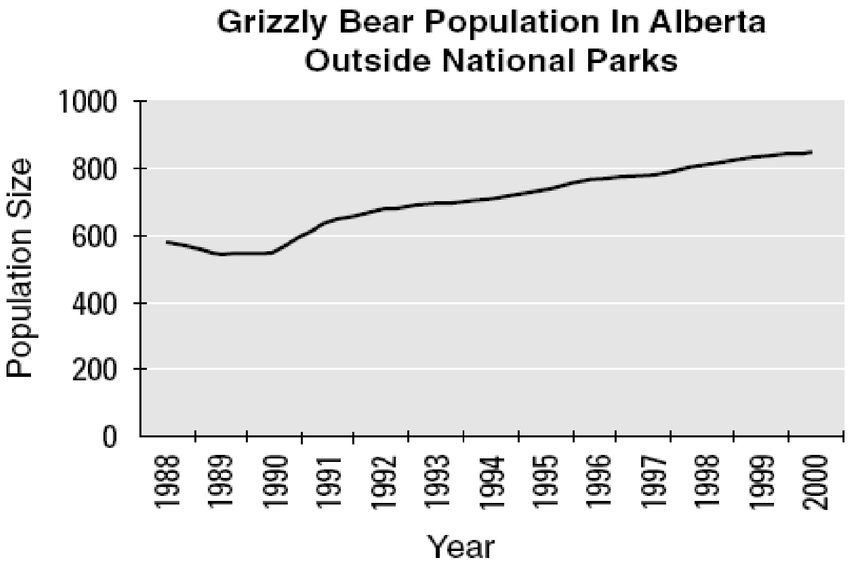
ANSWER KEY

Thought Lab 20.2: What Limits the Growth of Grizzly Bear Populations? Answer Key

BLM 20.1.8A

Procedure

The following graph shows the change in size of the Alberta grizzly bear population outside the National Parks over time.



Answers to Analysis Questions

1. 1990

2. Limiting hunting licenses probably occurred in 1988, but because of their low biotic potential, it took a few years for the bear population to begin to recover.

3. $cgr = \frac{\Delta N}{N}$

cgr 1991 to 1992: $\frac{669-638}{638} = 31/638 = 0.463$ or 4.6%

cgr 1997 to 1998: $\frac{807-776}{776} = 31/776 = 0.399$ or 4.0%

cgr 1998 to 1999: $\frac{833-807}{807} = 26/807 = 0.32$ or 3.2%

The per capita growth rate is decreasing because the bear population is approaching the carrying capacity of the environment. This may be due to loss of habitat because of human activities like logging or recreational development.

Thought Lab 20.2: What Limits the Growth of Grizzly Bear Populations? (cont'd)

4. a) Region A: $\frac{(31 \text{ bears})(1000)}{14\ 128 \text{ km}^2} = 2.2 \text{ bears/1000 km}^2$

Region B: $\frac{(44 \text{ bears})(1000)}{6089 \text{ km}^2} = 7.2 \text{ bears/1000 km}^2$

Region C: $\frac{(168 \text{ bears})(1000)}{22\ 840 \text{ km}^2} = 7.4 \text{ bears/1000 km}^2$

b) You might suggest that because bears require a wide variety of foods, the bear population would be denser in a region where more food is available. Sparsely populated areas could also lack suitable den space to survive the winter. Bears prefer moist temperate mountainous areas as opposed to dry cold mountain regions. Some of the regions might consist mainly of flat plains and have a lower population density as a result. Any well-reasoned answer is acceptable.

5. Disease and aggression due to intraspecific competition are possible causes of death.

6. a) Because females tend to remain in more restricted areas, genetic diversity in the population would decrease.

b) If a hesitation to cross barriers exists, this would decrease the chance of mating and could lead to a lower per capita growth rate.

7. a) Grizzly bears have *K*-selected life strategies. They take a relatively long time to become sexually mature, produce few offspring, and care for their young.

b) When conditions are ideal, females only average one offspring per year, less when the food supply diminishes. It would take a while for the population to increase.

c) Due to the low biotic potential of grizzly bears, conservationists require long term plans to maintain or increase the population size. Every loss of a cub or sexually mature bear from the population requires an increase in the birth rate of the population, something that is difficult to attain when conditions are not ideal.

8. Yes, it is reasonable to lower the speed limit on this stretch of highway. The time lost on a trip is negligible. One question that you may want to ask is if there is evidence that bears have been killed in vehicle accidents in this area.

9. Industries competing for grizzly bear habitat include the forestry, oil and gas, utilities, and agricultural industries, along with human recreational activities like hunting. A management board consisting of representatives from these areas, as well as the federal and provincial governments, has been established in Alberta. Some keys to success are to limit the amount of hunting that can be done each year and intensively manage multiple use areas, reduce conflicts between bears and cattle farmers, and decrease human activities in areas of high quality bear habitat.

Investigation 20.A: Interspecific and Intraspecific Competition Among Seedlings Answer Key

Answers to Analysis Questions

1. In Part 1, you tested the effect of intraspecific competition on the growth of individual seedlings in a population. The manipulated variable in this experiment was the amount of intraspecific competition, which you could have altered by planting seeds close together in one pot and progressively farther apart in additional pots. Alternatively, you could have planted a specific number of seeds in a series of pots (e.g., 2 seeds in the first pot, 4 in the second, 6 in the third, and so on).

2. In general, you should find that measuring the "wet" biomass of the seedlings or the height of individual seedlings is effective.

3. **a)** Your answer will depend on the overall number of seeds you planted, how closely you planted the seeds in one pot compared to another, and the number of pots of seedlings you used. In general, the more trials that you run, the more useful your results will be.

b) To demonstrate interspecific competition, you may find that some combinations of seedlings work better than others. Probably you will find that the radish, lettuce, grass, clover, and bean seedlings grow faster than the basil or marigold seedlings. A combination of fast-growing seedlings and slow-growing seedlings can be used to demonstrate the ability of one population to out-compete another population. Seedlings that grow at the same rate can be used to demonstrate the inhibition of growth of members of both competing populations. A series of pots can be used to test the effect of growing different ratios of two seed-types together. The results should be compared to the growth of seedlings that were grown with only one type of seed per pot (control trial).

4. You should mention incorrect assumptions or poorly controlled variables. For example, if you measured the "wet" biomass of the seedlings, you may state that it would be more correct to measure the seedlings' dry biomass. Also, variables that could give one type of seedling an advantage over another type of seedling should be properly controlled, or even tested, in future experiments. Different plant species have different growth requirements, such as an optimal growth temperature, optimal amount of light for seed germination, and optimal amount of available water.

Answers to Conclusion Questions

5. You should have found that beyond a certain planting density, increasing the degree of intraspecific competition among seedlings resulted in fewer surviving seedlings, smaller seedlings (as measured by total or average biomass, or average height), or both fewer and smaller seedlings.

6. You will have been able to detect the effect of intraspecific competition on the entire seedling population if they measured the total biomass of the seedlings. Overall, the more intense the intraspecific competition, the more it reduces the overall growth (in biomass) of a seedling population.

Investigation 20.A: Interspecific and Intraspecific Competition Among Seedlings (cont'd)

7. As a result of interspecific competition for soil nutrients, water, and perhaps light, when two types of seedlings were grown together, members of one or both of the populations did not grow as well as they would have if grown alone.

8. Fast-germinating, fast-growing seedlings were able to outcompete the slower-growing seedlings, which did not grow as well as they would have if grown alone.

9. In testing intraspecific competition in seedlings, the greater the death rate during germination, the fewer seedlings there would be to compete with one another later on. You might hypothesize that plants with low germination rates (high death rates during germination) will produce healthier populations when planted close together, compared to plants with higher germination rates. You could test this hypothesis by comparing densely planted seedlings of plants with different germination rates.

Since the death rate of plants is highest during germination, in Part 2, those plants with a higher germination rate would have had a competitive advantage over other plants with lower germination rates. Adult plants would not have this competitive advantage, and interspecific competition between adult plants would be due to their relative ability to obtain soil nutrients, water, light, and room to grow. Planting different ratios of adult plants in a garden plot and measuring the amount or rate of growth of individual plants, or the biomass of each population could test this hypothesis.

DATE: NAME: CLASS:

CHAPTER 20
ANSWERS

Symbiotic Relationships Answer Key

BLM 20.2.3A

Symbiosis

Definition: relationship between individuals of different species; usually involves an organism that lives or feeds in or on another organism (host)

Mutualism

a type of symbiotic relationship

Definition

both partners benefit from the relationship, or depend on it in order to survive

Example

lichen (combination of an alga and a fungus)

Example

certain species of *Acacia* tree and stinging ants

Parasitism

a type of symbiotic relationship

Definition

one organism benefits by living on or in an organism of a different species that is harmed by the association

Example

Giardia sp. and humans

Example

tapeworms and livestock

Commensalism

a type of symbiotic relationship

Definition

one individual benefits by living on or close to another; the host neither benefits, nor is harmed by the association

Example

remora fish and a shark

Example

cow birds and cattle