

Name \_\_\_\_\_ Period \_\_\_\_\_

## Chapter 53: Population Ecology

The next three chapters on population, community, and ecosystem ecology provide the academic backbone for this unit on ecology. Each chapter is a different organizational level in ecology, starting with population ecology. Before beginning your study of each chapter, be sure you have a clear understanding of the terms in the chapter title.

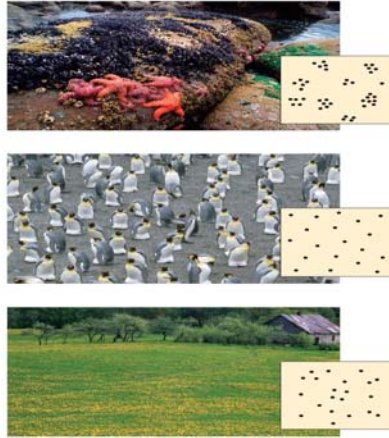
### ***Concept 53.1 Dynamic biological processes influence population density, dispersion, and demographics***

1. What two pieces of data are needed to mathematically determine *density*?
2. What is the difference between density and *dispersion*?
3. Work through Figure 53.2, doing the math to make sure you get the same answer as the text. Note and understand what the letters of the formula mean. Next, try the following problem.

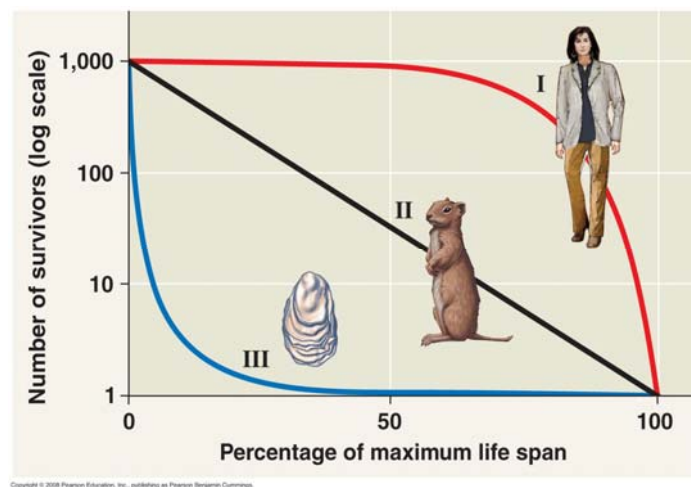
A population ecologist wished to determine the size of a population of white-footed deer mice, *Peromyscus leucopus*, in a 1-hectare field. Her first trapping yielded 80 mice, all of which were marked with a dab of purple hair dye on the back of the neck. Two weeks later, the trapping was repeated. This time 75 mice were trapped, out of which 48 of the mice were marked. Using the formula  $N = mn/x$ , what is the population of mice in the field? (Answer is at the end of this reading guide.)

4. Explain the impact of *immigration* and *emigration* on population density. (To avoid confusion between these two terms, it might help to use this memory trick: immigration is the movement into a population, while emigration is the exiting of individuals from a population.)

5. Label the dispersion pattern shown by each population in the figure below. Second, and most important, what do the dispersion patterns tell us about the population and its interactions?



6. In what population statistic do *demographers* have a particular interest? How is this data often presented?
7. Is your biology class a *cohort*? Explain.
8. *Survivorship curves* show patterns of survival. In general terms, survivorship curves can be classified into three types. Using the figure below, label and explain the three idealized survivorship patterns.



9. In the natural world, many species show survivorship curves that are combinations of the standard curves. How would an open nesting songbird's survivorship curve appear if it was Type III for the first year and then Type II for the rest of its life span? Sketch this curve on the survivorship curve graph in question 8.
10. What does a *reproductive table* show?

***Concept 53.2 Life history traits are products of natural selection***

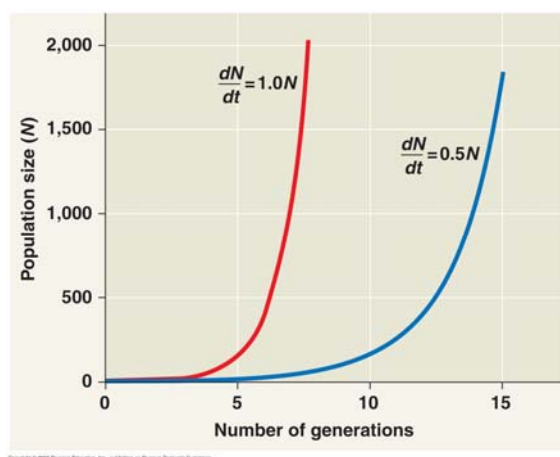
11. On what is the *life history* of an organism based?
12. What three variables form the life history of a species?
13. Explain the difference between *semelparity* (*big-bang reproduction*) and *iteroparity* (*repeated reproduction*) as life history strategies.
14. Explain how two critical factors influence whether a species will evolve toward semelparity or iteroparity.
15. Explain the effect of offspring care on parental survival in kestrels.

***Concept 53.3 The exponential model describes population growth in an idealized, unlimited environment***

Do not let the math in this section be a problem. Instead of trying to understand the calculus involved, concentrate on the idea of exponential growth, how it is graphed, and what this type of growth indicates about a population.

16. What is the advantage to using per capita birth and death rates rather than just the raw numbers of births and deaths?

17. What will the per capita birth and death rates be if a population is demonstrating *zero population growth*?
18. What does it mean for a population to be in *exponential population growth*?
19. In the graph below, explain why the line with the value of 1.0 shows a steeper slope that reaches exponential growth more quickly than does the line with the value of 0.5. On this graph, add a third line that approximates a population with an exponential value of 1.25.

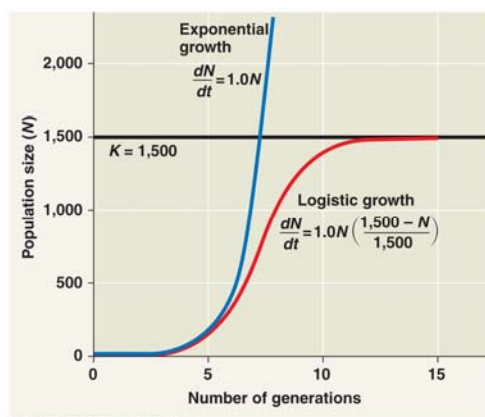


20. What are two examples of conditions that might lead to *exponential population growth* in natural populations?

**Concept 53.4** *The logistic model describes how a population grows more slowly as it nears its carrying capacity*

21. What is *carrying capacity*?
22. What are six examples of limiting resources that can influence carrying capacity?
23. In the *logistic population growth* model, the per capita rate of increase approaches zero as the \_\_\_\_\_ is reached.

24. If the carrying capacity (or  $K$ ) is 1,000 and  $N$  is 10, the term  $(K - N)/K$  is large. Explain why a large value for  $(K - N)/K$  predicts growth close to the maximum rate of increase for this population.
25. In the graph below, explain why the logistic model predicts a sigmoid (S-shaped) growth curve when the population density is plotted over time. Hint: The critical part of this answer concerns why growth slows as  $N$  approaches  $K$ .



26. The end of this concept attempts to bring together the ideas of life histories and growth models. This is done with the introduction of two new terms:  $K$ -selection and  $r$ -selection. Explain the ideas behind the creation of these two terms.
27. Compare and contrast these two terms:

**density-independent regulation**

**density-dependent regulation**

28. Explain how negative feedback plays an essential role in the unifying theme of regulation of populations. Does negative feedback play a role in both density-independent and density-dependent regulation?

29. Complete the following chart.

**Density-Dependent Population Regulation**

<b>Negative Feedback Mechanism</b>	<b>Explanation</b>	<b>Example</b>
<i>Competition for resources</i>		
<i>Territoriality</i>		
<i>Disease</i>		
<i>Predation</i>		
<i>Toxic wastes</i>		
<i>Intrinsic factors</i>		

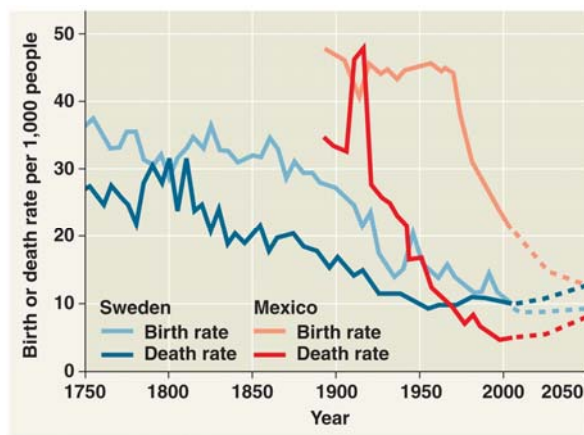
30. Give both biotic and abiotic reasons for population fluctuations over the last 50 years in the moose population on Isle Royale, based on *population dynamics*.

31. Explain the importance of immigration and emigration in *metapopulations*.

**Concept 53.5 The human population is no longer growing exponentially but is still increasing rapidly**

32. Summarize human population growth since 1650. (Of all the reported statistics, which one surprises you the most?)

33. What is *demographic transition*? Use the figure below to explain the process in Sweden and Mexico.



34. You should be able to look at *age-structure graphs* and make predictions about the future growth of the population. Using Figure 53.25, describe the key features for the three age-structure graphs and predict how the population of each country will grow.

Country	Key Features	Predicted Future Growth
Afghanistan		
United States		
Italy		

35. Why do *infant mortality* and *life expectancy* vary so greatly between certain countries?
36. Can the world's population sustain an *ecological footprint* that is currently the average American footprint? Explain.

### Testing Your Knowledge: Self-Quiz Answers

Now you should be ready to test your knowledge. Place your answers here:

1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ 4. \_\_\_\_\_ 5. \_\_\_\_\_ 6. \_\_\_\_\_ 7. \_\_\_\_\_ 8. \_\_\_\_\_ 9. \_\_\_\_\_ 10. \_\_\_\_\_

Answer to Question 3: 125 *P. leucopus*