# Guided Reading: Chapter 50

(p.1093)**1.** Define the following terms:

**a.** **Abiotic** – The nonliving, chemical and physical factors part of an environment.
Examples: temperature, water and light.

**b.** **Biotic** – All of the LIVING organisms that are part of the environment.

**c.** Give an example of the interactions of biotic and abiotic factors.

**2.** List the factors that affect dispersal of organisms. (pp. 1095-1102)

Factors that affect the dispersal of organisms include:
(1) Predation
(2) Biogeography
(3) Temperature
(4) Water
(5) Sunlight
(6) Wind
(7) Rocks and Soil
(8) Climate and Biomes
(9) Global Climate Patterns

**3.** Use the **Figure 50.8** to help you describe the expansion of the zebra mussel across the US since its discovery in Detroit in 1988. (pp.1097-1098)

Since 1988, zebra mussels have spread rapidly in the river systems of the Central United States. By feeding on phytoplankton (microscopic plants - base of the food chain), the mussels depress populations of zooplankton (microscopic animals) and make the eater clearer and allow more sunlight increasing the growth of rooted aquatic plants in shallow waters. Because their predators are too few, zebra mussels crowd out native species leading to their extinction.

(p.1183)**4.** Define **Biomass**. Biomass is the sum weight of all the individuals in a population.

(pp.1097-1098) *(Imported or Invasive Species)*

**5.** Describe and explain the effects zebra mussels had on the biomass of each of the following organisms found in the Hudson River:

**(a)** phytoplankton - As suspension feeders, Zebra mussels feed on phytoplankton thus decreasing the biomass of phytoplankton in the Hudson River which makes the water in the Hudson River clearer.

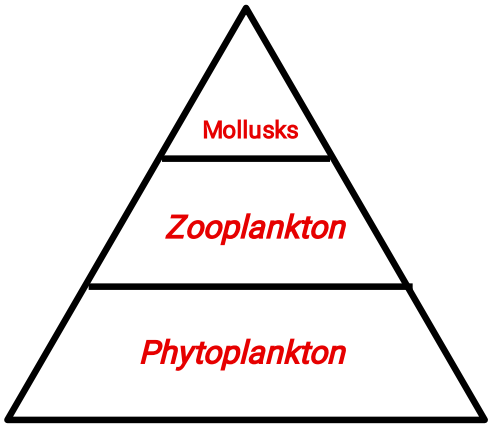
**(b)** zooplankton - Without phytoplankton to feed on, the population of zooplankton decreases thus decreasing the biomass of zooplankton in the Hudson River.

**(c)** native mollusks - Without zooplankton to feed on, the population of native mollusks decreases thus decreasing the biomass of mollusks in the Hudson River.

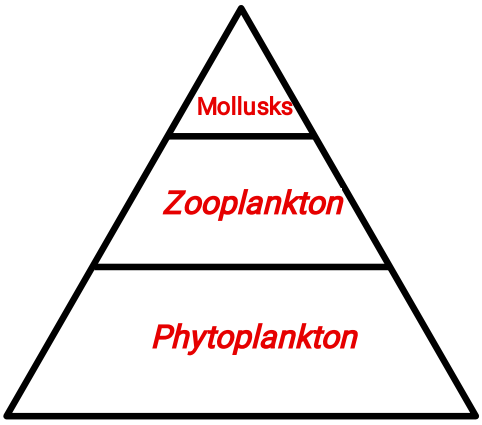
(p.1181) **6.** Construct a food chain, a food pyramid and a biomass pyramid for the organisms affected by the introduction of zebra mussels in the Hudson River.

**phytoplankton ⟶ zooplankton ⟶ mollusks**

*(producer)* *(primary consumer)* *(secondary consumer)*




**Food Pyramid**




**Biomass Pyramid**

# Chapter 52: Population Ecology

## OBJECTIVES:

**Characteristics of Populations**

__1. Define the scope of population ecology
__2. Define and distinguish between density and dispersion.
__3. Explain how ecologists measure the density of a species.
__4. Describe the characteristics of populations that exhibit Type I, Type II, and Type III survivorship curves.

**Population Growth**

__5. Compare the geometric model of population growth with the logistic model.
__6. Explain how an environment's carrying capacity affects the intrinsic rate of increase of a population.
__7. Distinguish between r-selected populations and K-selected populations.

**Population-Limiting Factors**

__8. Explain how density-dependent factors affect population growth.
__9. Explain how density-dependent and density-independent factors may work together to control a population's growth.
__10. Explain how predation can affect life history through natural selection.
__11. Describe several boom-and-bust population cycles, noting possible causes and consequences of the fluctuations.

**Human Population Growth**

__12. Describe the history of human population growth.
__13. Define the demographic transition.
__14. Compare the age structures of Italy, Kenya, and the United States. Describe the possible consequences for each country.
__15. Describe the problems associated with estimating Earth's carrying capacity.

## KEY TERMS:

| | | | |
|---|---|---|---|
| carrying capacity | demography | density dependent | density independent |
| dispersion | K-selection | logistic population growth | population |
| r-selection | survivorship curve | | |

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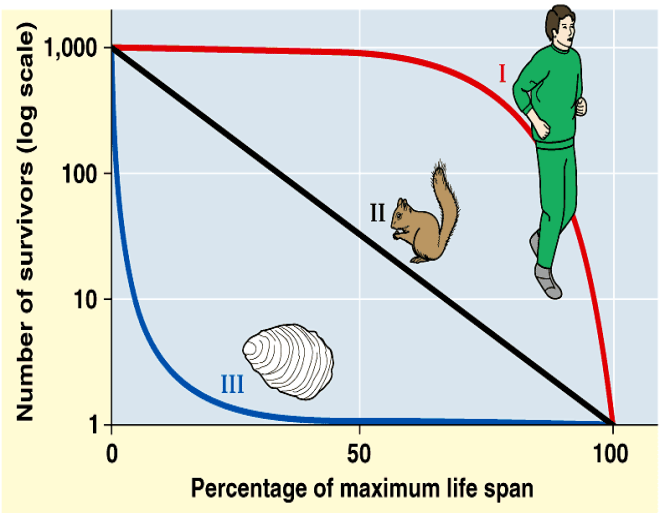
## WORD ROOTS:

**co-** = together (*cohort*: a group of individuals of the same age, from birth until all are dead)
**demo-** = people; **-graphy** = writing (*demography*: the study of statistics relating to births and deaths in populations)
**itero-** = to repeat *(iteroparity*: a life history in which adults produce large numbers of offspring over many years; also known as iteroparity)
**semel-** = once; **-parity** = to beget (*semelparity*: a life history in which adults have but a single reproductive opportunity to produce large numbers of offspring, such as the life history of the Pacific salmon; also known as "big-bang reproduction")

# Guided Reading: Chapter 52

(p.1151) **7.** What is a **population**? A population is a group of individuals of a single species that simultaneously occupy the same general area.

(p.1154) **8.** Using the graph to the right to describe and compare each of the following survivorship curves and give a few examples of each.




**a. Type I**

Flat at the start reflecting low death rates early and middle life, then drops steeply as death rates increase among older age groups.
EXAMPLES: humans and many other large mammals

**b. Type II**

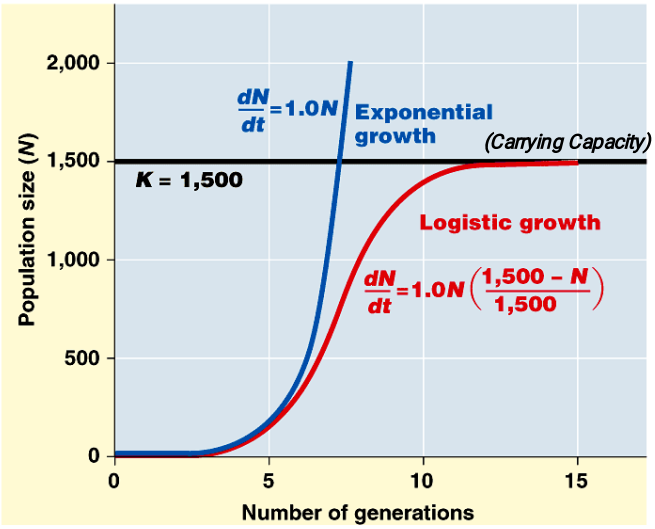
Show a constant death rate over a life span.
EXAMPLES: Annual plants, some lizards and rodents like the gray squirrel.

**c. Type III**

Drops sharply at the start reflecting very high death rates for the young, but flatten out as death rates decline for those few individuals that have survived to a certain critical age.
EXAMPLES: Many fishes and marine invertebrates.

Bozeman: Exponential Growth  Logistic Growth

(p.1160) **9.** Use the graph to the right to explain the differences, between **exponential population growth** and **logistic population growth**?




Exponential growth occurs under ideal conditions when there are unlimited resources leading to a rapid increase in a population and a J-shaped curve. Logistic growth takes into account population density, limited resources and changes that occur as the population nears the carrying capacity.

(p.1160) **10.** Define **carrying capacity**. (K)

Carrying capacity is the maximum population size that at particular environment can support at a particular time with no degradation in the habitat.

*(In a sustainable fashion)*

(p.1160) **11.** What happens to population growth when the number of individuals approaches **carrying capacity**?

When the number of individuals approaches carrying capacity (K), resources become limited, competition increases and population growth decreases.

**12.** Compare **K-selected** (*density-dependent selection*) to **r-selected** (*density-independent selection*) species. Give examples of each.

*(Aim for huge exponential growth: $r_{max}$ = maximum population growth)*

*(Aim for carrying capacity)*

| | r-strategy | k-strategy |
|---|---|---|
| **Offspring (*per brood*)** | MANY offspring produced. | FEW offspring produced. |
| **Parental care** | LITTLE to NO parental care. | Long period of parental care. |
| **Mortality** | HIGH mortality (death) rate. | LOW mortality (death) rate |
| **Body Size** | SMALL body size. | LARGE body size. |
| **Onset of Maturity** | EARLY maturity. | LATE maturity. |
| **Reproduction** | Individuals reproduce ONCE. | Individuals reproduce more than once. |
| **Favored Environment** | UNSTABLE environments. | STABLE environments. |
| **Examples** | (1) insects<br>(2) rodents<br>(3) weeds (dandeloins) | (1) Humans<br>(2) Elephants<br>(3) Dolphins |

(Bozeman Video)  (Crash Course Video)

(p.1164) **13.** Identify factors that regulate population size.

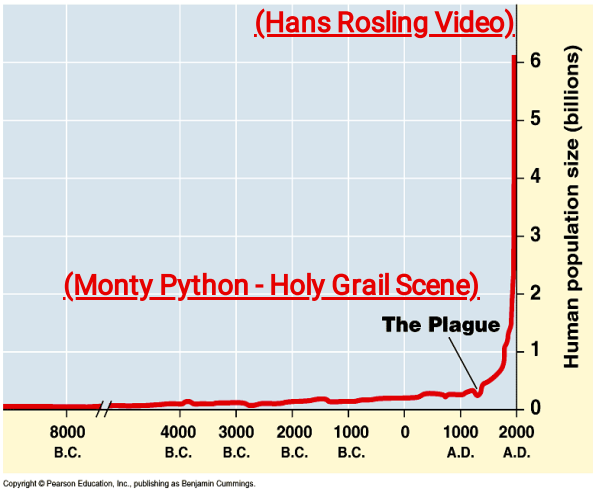
Factors that regulate population size are called limiting factors. Limiting factors include: predation - sickness (viruses and bacteria) - food - water - temperature - sunlight.

(Video: How Did We Get So Big So Fast?)

(p.1168) **14.** Look at the growth curve of the human population. How does it compare to the growth curves mentioned in question 9?

The human population growth curve to the right is an example of logistic growth from 8000 B.C. until the Bubonic (Black) Plague in 1347. Since the Industrial Revolution in the 1800's, human population growth has experienced exponential growth since 1960 since the is linear and characteristic of logistic growth.

(Hans Rosling Video)





(Video: Human Population Through Time)

**15.** Have humans reached **K**? What factors are significant when explaining our growth curve?

According to Hans Rosling, the carrying capacity of *Homo sapiens* for planet Earth is 11 billion. Significant factors in explaining our growth curve include:

(Video TedEd)

**16.** Look at the age structure diagrams of different countries. Be prepared to discuss in class how each might influence various personal, governmental and economic policy?