

### Reproductive Potential

- Reproductive potential increases when individuals produce more offspring at a time, reproduce more often, and reproduce earlier in life.
- Reproducing earlier in life has the greatest effect on reproductive potential.
- Reproducing early shortens the generation time, or the average time it takes a member of the population to reach the age when it reproduces.

### Reproductive Potential

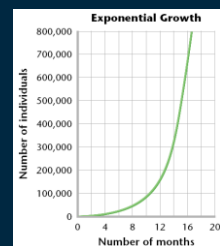
- Small organisms, such as bacteria and insects, have short generation times and can reproduce when they are only a few hours or a few days old.
- As a result, their populations can grow quickly.
- In contrast, large organisms, such as elephants and humans, become sexually mature after a number of years and therefore have a much lower reproductive potential than insects.

### Exponential Growth

- **Exponential growth** is logarithmic growth or growth in which numbers increase by a certain factor in each successive time period.
- Exponential growth occurs in nature only when populations have plenty of food and space, and have no competition or predators.
- For example, population explosions occur when bacteria or molds grow on a new source of food.

### Exponential Growth

- In exponential growth, a large number of individuals is added to the population in each succeeding time period.



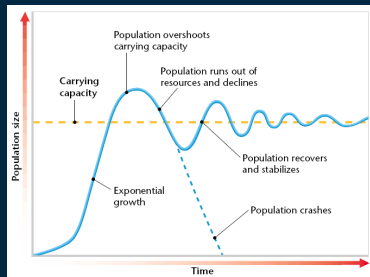
### What Limits Population Growth?

- Because natural conditions are neither ideal nor constant, populations cannot grow forever.
- Eventually, resources are used up or the environment changes, and deaths increase or births decrease.
- Under the forces of natural selection in a given environment, only some members of any population will survive and reproduce. Thus, the properties of a population may change over time.

### Carrying Capacity

- **Carrying capacity** is the largest population that an environment can support at any given time.
- A population may increase beyond this number but it cannot stay at this increased size.
- Because ecosystems change, carrying capacity is difficult to predict or calculate exactly. However, it may be estimated by looking at average population sizes or by observing a population crash after a certain size has been exceeded.

## Carrying Capacity



◀ Back Next ▶ Preview Main

## Resource Limits

- A species reaches its carrying capacity when it consumes a particular natural resource at the same rate at which the ecosystem produces the resource.
- That natural resource is then called a *limiting resource*.
- The supply of the most severely limited resources determines the carrying capacity of an environment for a particular species at a particular time.

◀ Back Next ▶ Preview Main

## Competition Within a Population

- The members of a population use the same resources in the same ways, so they will eventually compete with one another as the population approaches its carrying capacity.
- Instead of competing for a limiting resource, members of a species may compete indirectly for social dominance or for a territory.
- Competition within a population is part of the pressure of natural selection.

◀ Back Next ▶ Preview Main

## Competition Within a Population

- A territory is an area defended by one or more individuals against other individuals.
- The territory is of value not only for the space but for the shelter, food, or breeding sites it contains.
- Many organisms expend a large amount of time and energy competing with members of the same species for mates, food, or homes for their families.

◀ Back Next ▶ Preview Main

## Two Types of Population Regulation

- Population size can be limited in ways that may or may not depend on the density of the population.
- Causes of death in a population may be density dependent or density independent.

◀ Back Next ▶ Preview Main

## Population Regulation

- When a cause of death in a population is density dependent, deaths occur more quickly in a crowded population than in a sparse population.
- This type of regulation happens when individuals of a population are densely packed together.
- Limited resources, predation and disease result in higher rates of death in dense populations than in sparse populations.

◀ Back Next ▶ Preview Main

### Population Regulation

- When a cause of death is density independent, a certain proportion of a population may die regardless of the population's density.
- This type of regulation affects all populations in a general or uniform way.
- Severe weather and natural disasters are often density independent causes of death.