Population Ecology

Population Dynamics

- Population:
  - All the individuals of a species that live together in an area

- Demography:
  - The statistical study of populations, allows predictions to be made about how a population will change

Population Dynamics

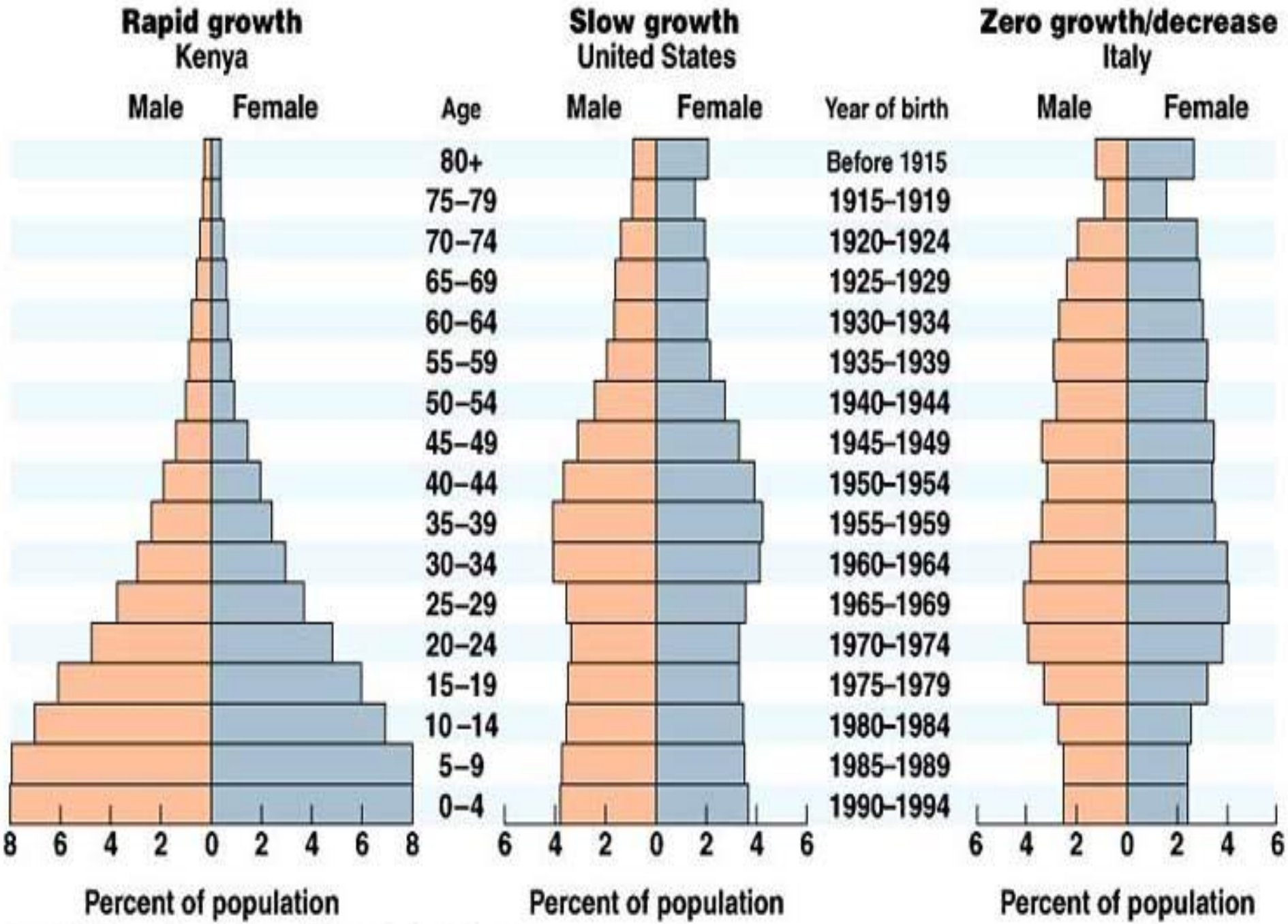
- Three Key Features of Populations
  - Size
  - Density
  - Dispersion

Three Key Features of Populations

Size: number of individuals in an area

Three Key Features of Populations

- Growth Rate:
  - Birth Rate (natality) - Death Rate (mortality)
  - How many individuals are born vs. how many die
  - Birth rate (*b*) − death rate (*d*) = rate of natural increase (*r*)



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Three Key Features of Populations

Density: measurement of population per unit area or unit volume

Pop. Density = # of individuals ÷ unit of space

How Do You Affect Density?

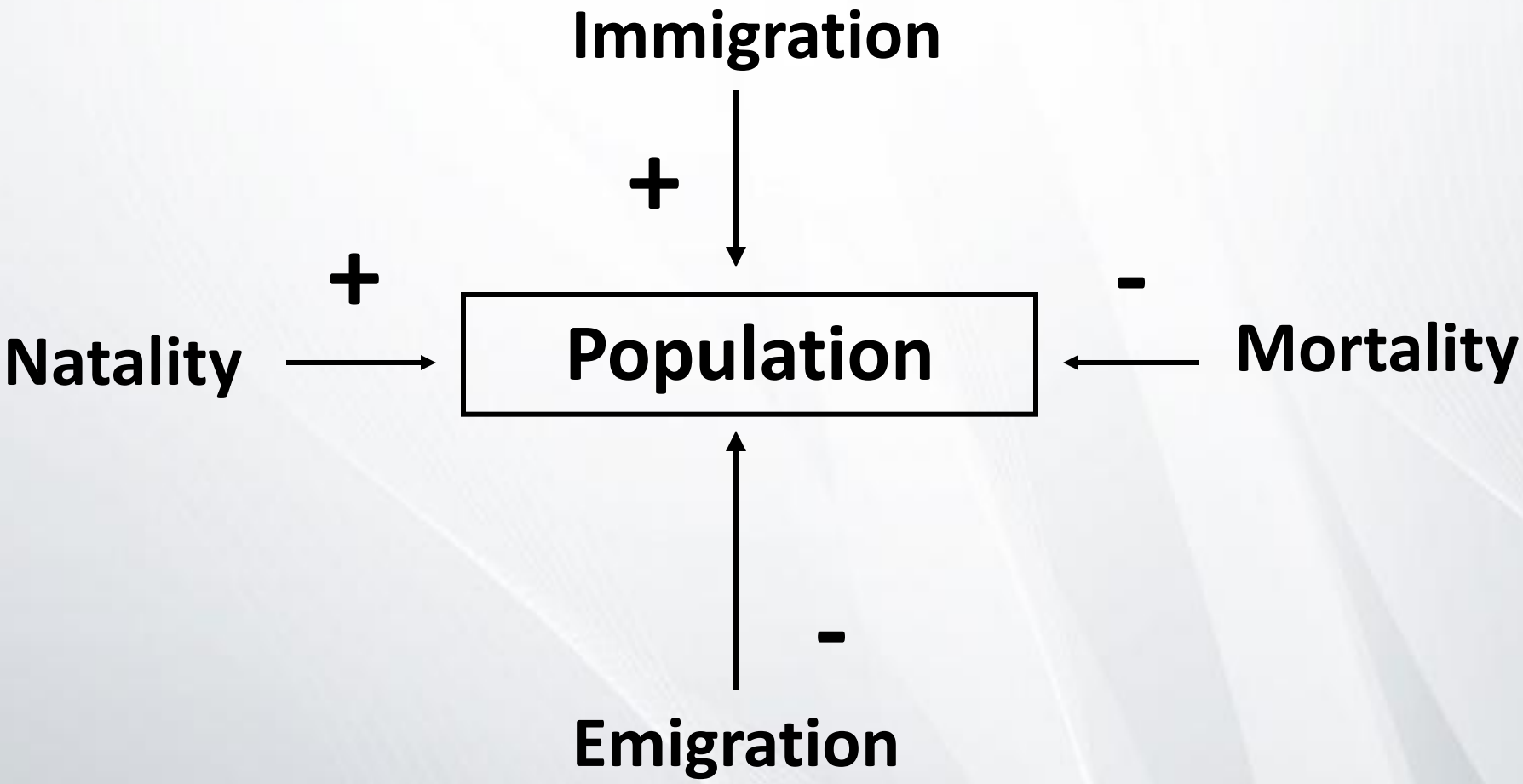
1. Immigration: movement of individuals into a population

2. Emigration: movement of individuals out of a population

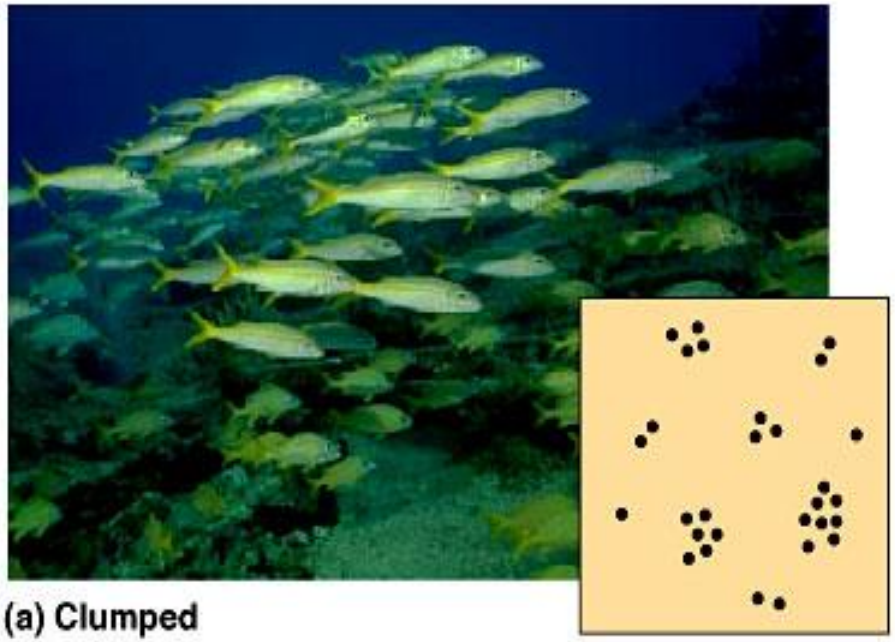
3. Density-dependent factors: Biotic factors in the environment that have an increasing effect as population size increases (disease, competition, parasites)

4. Density-independent factors: Abiotic factors in the environment that affect populations regardless of their density (temperature, weather)

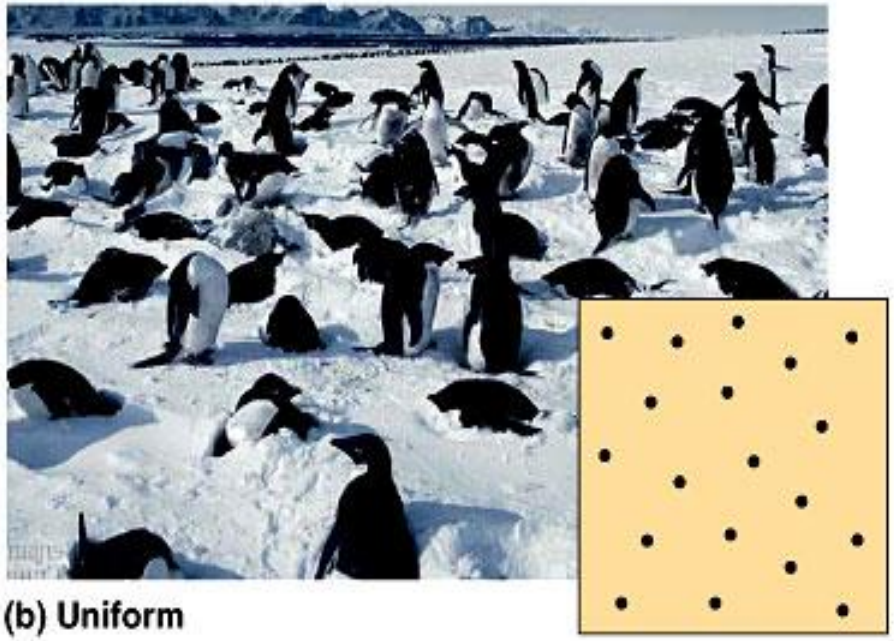
Factors That Affect Future Population Growth



Population Dispersion



(a) Clumped



(b) Uniform

(c) Random

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Three Key Features of Populations

- Dispersion: describes the spacing of organisms relative to each other
  - Clumped
  - Uniform
  - Random

How Are Populations Measured?

- Population density = number of individuals in a given area or volume
- Count all the individuals in a population
- Estimate by sampling
- Mark-Recapture Method

How Do Populations Grow?

- Idealized models describe two kinds of population growth:

1. Exponential Growth

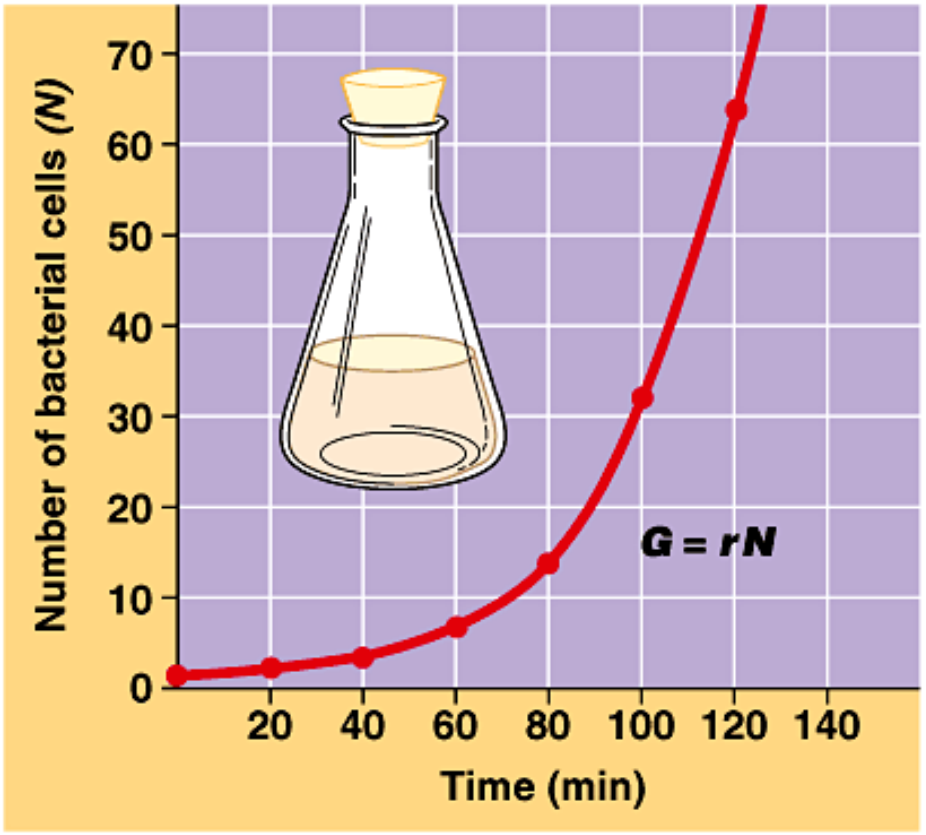
2. Logistic Growth

Carrying Capacity

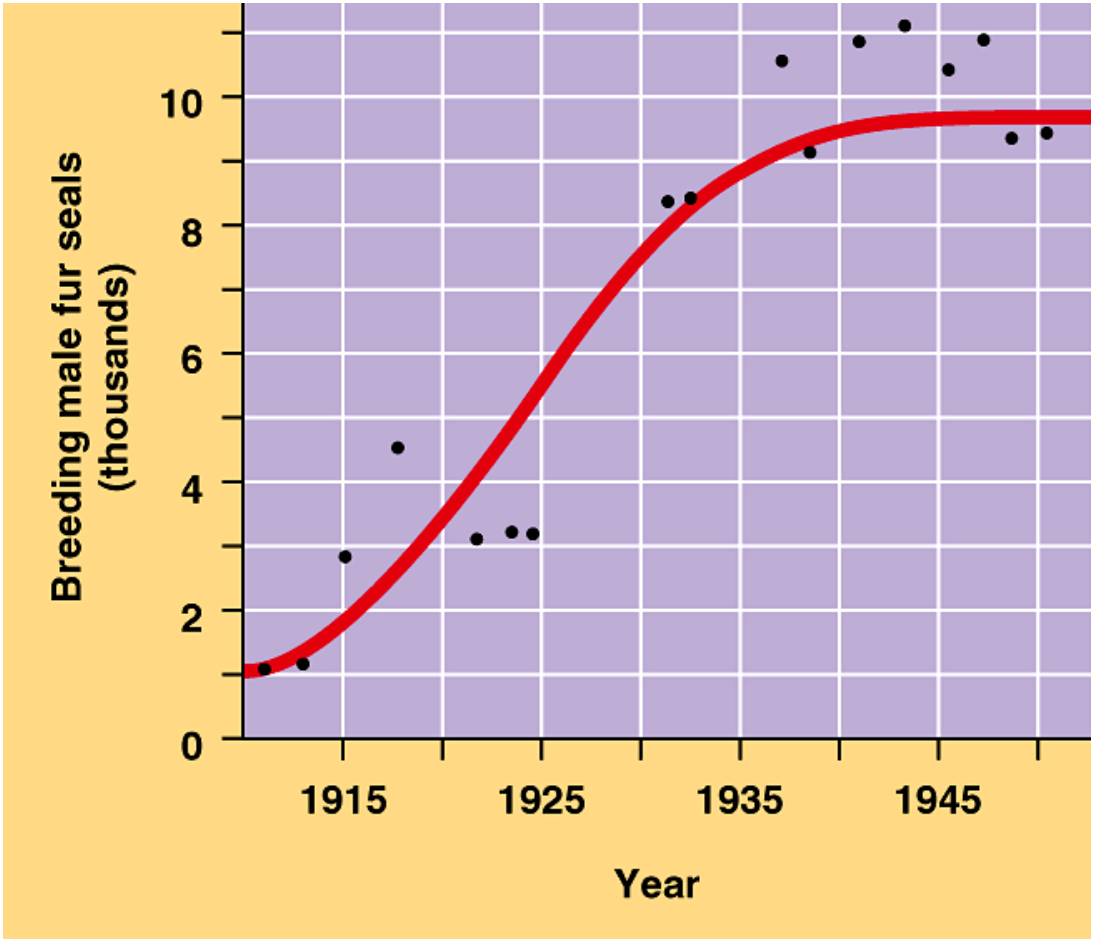
- **Carrying Capacity (k):**
  - The maximum population size that can be supported by the available resources
  - There can only be as many organisms as the environmental resources can support

Exponential Growth Curve

Time	Number of Cells	
0 minutes	1	$= 2^0$
20	2	$= 2^1$
40	4	$= 2^2$
60	8	$= 2^3$
80	16	$= 2^4$
100	32	$= 2^5$
120 (= 2 hours)	64	$= 2^6$
3 hours	512	$= 2^9$
4 hours	4,096	$= 2^{12}$
8 hours	16,777,216	$= 2^{24}$
12 hours	68,719,476,736	$= 2^{36}$



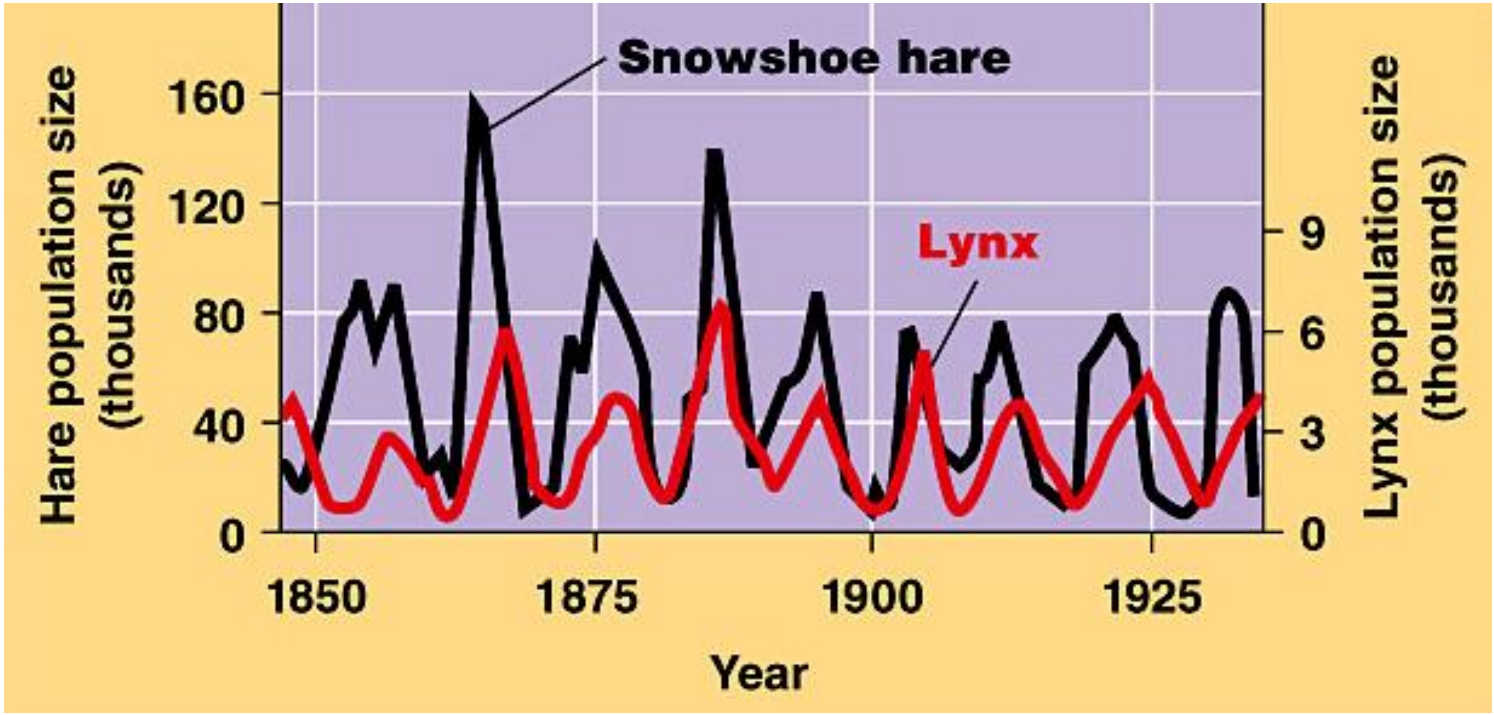
Logistic Growth Curve



Factors Limiting Growth Rate

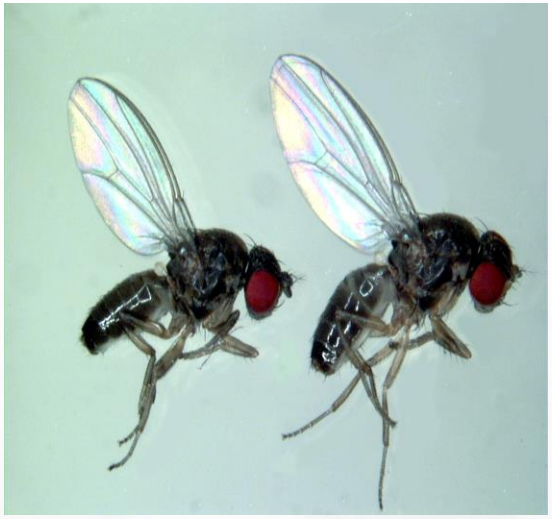
- Declining birth rate or increasing death rate are caused by several factors including:
  - Limited food supply
  - The buildup of toxic wastes
  - Increased disease
  - Predation

“Booms” and “Busts”



Reproductive Strategies

- R Strategists
  - Short life span
  - Small body size
  - Reproduce quickly
  - Have many young
  - Little parental care
  - Ex: cockroaches, weeds, bacteria

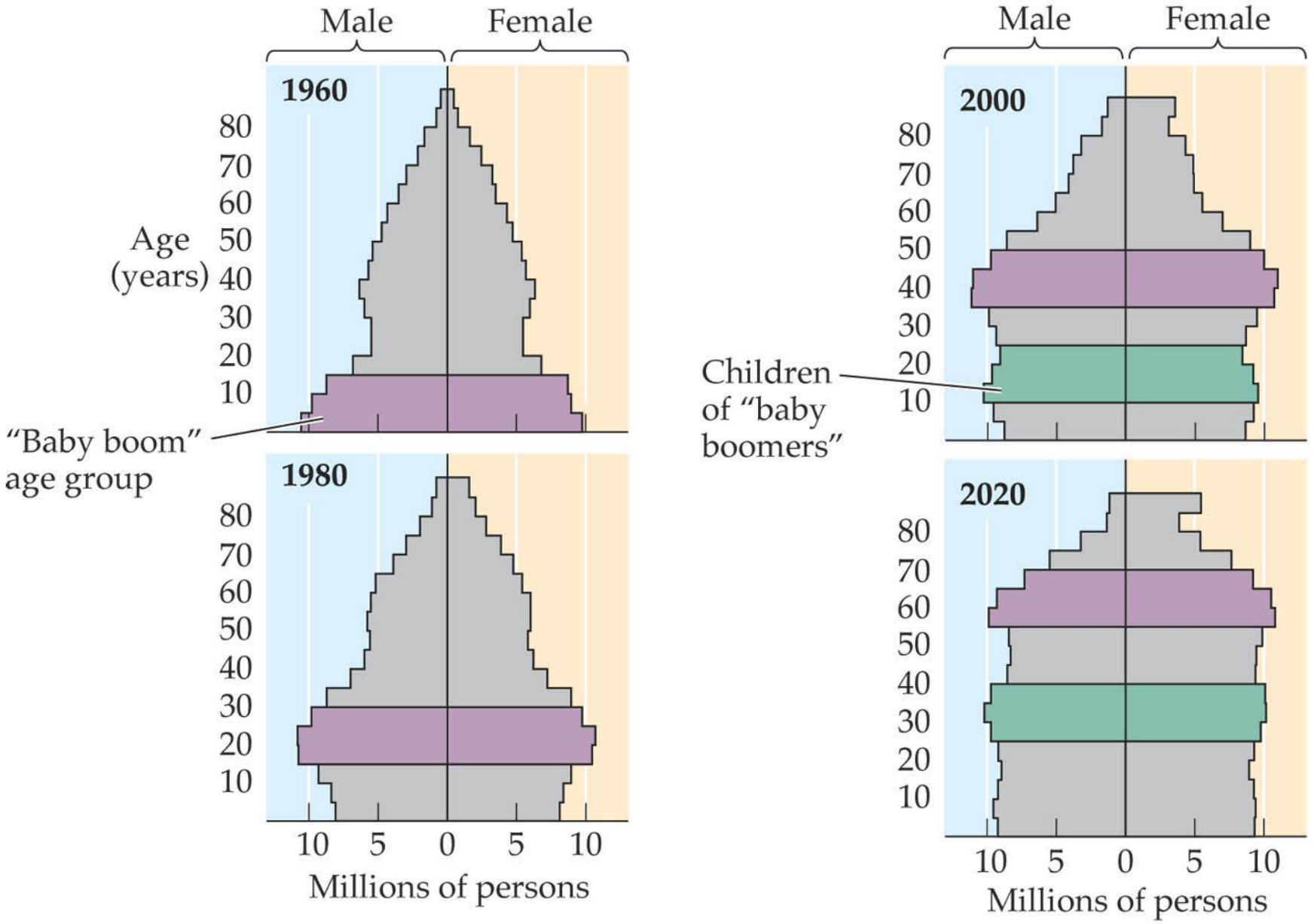


Reproductive Strategies

- K Strategists
  - Long life span
  - Large body size
  - Reproduce slowly
  - Have few young
  - Provides parental care
  - Ex: humans, elephants

Age Distribution

- Distribution of males and females in each age group of a population
- Used to predict future population growth



LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, **Figure 54.2 Age Distributions Change over Time**

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