

Understanding Population Growth

Ch. 8.1-8.3



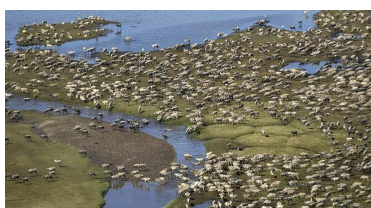
Population Ecology

- Population Ecology = Study of populations and why their numbers change over time
- Population = Group of individuals of same species living in the same geographic area at the same time



Population Density

- Population Density = The number of individuals of a species per unit area at a given time
- Individuals / area
- Ex: 1400 caribou/mi²
- Ex: 3 polar bears/mi²





3 Survivorship Curves

• Proportion of a population to survive to *breeding age*

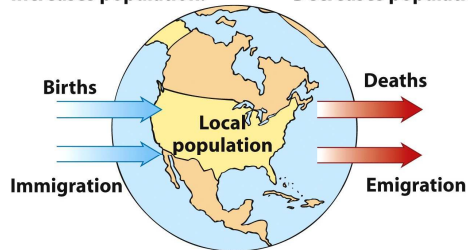
- Type I =
 - survival *decreases* with age
- Type II =
 - survival *doesn't change* with age
- Type III =
 - survival *increases* with age

Generalized survivorship curves

Generalized survivorship curves

Change in Population Size

Increases population: Decreases population:



In local populations, such as the population of the United States, the number of births, deaths, immigrants, and emigrants affect population size.

Calculating Population Change

Growth rate Death rate Emigration rate

↓ ↓ ↓

$$r = (b - d) + (i - e)$$

↑ ↑

Birth rate Immigration rate

$$r = \frac{(b - d) + (i - e)}{10}$$

Sample Calculations

1. A town of 1,000 people experienced 16 births and 12 deaths. Calculate the annual rate of growth.

$$r = \frac{(b - d) + (i - e)}{10} \quad r = 16 - 12 / 10 = 0.4\%$$

- A town of 20,000 people experienced a birth rate of 48 and a death rate of 18. Immigration and emigration were 12 and 3 respectively. Calculate the annual rate of growth.

$$r = \frac{(b - d) + (i - e)}{10} \quad r = (48 - 18) + (12 - 3) / 10 = 3.9\%$$

Density Dependent
 effect on population changes as **population density changes**

Density Independent
 affects population size, but is not influenced by changes in population density

Where do these factors fit?

- Predation
- Killing frost
- Disease
- Competition
- Severe blizzard

Population Distribution

(a) Clumped
 • Patchy Resource Distribution
 • Most Common Type

(b) Uniform
 • Evenly Spaced
 • Organisms compete for scarce resources

(c) Random
 • Unpredictable
 • Organisms do not interact much.

Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

Where boys are off balance
 Males per 100 females at birth, 2000-05

Population Sex Ratio

The ratio of males to females.

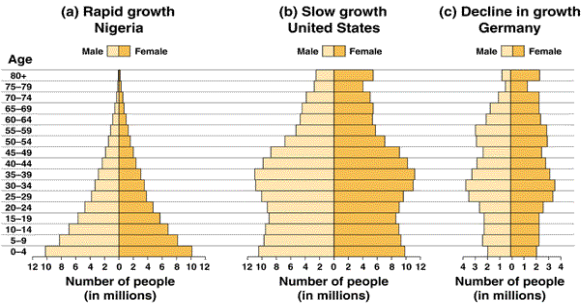
Worldwide 101 males to 100 females

Country	Males per 100 females
China	~120
Armenia	~115
Azerbaijan	~115
Georgia	~115
South Korea	~110
India	~105
Serbia	~105
Belarus	~105
Bosnia	~105
Cyprus	~105
Hong Kong	~105
Singapore	~105

Source: United Nations

Population Age Structure

Age Structure Diagrams - shows the **percentage** of population by age and gender.



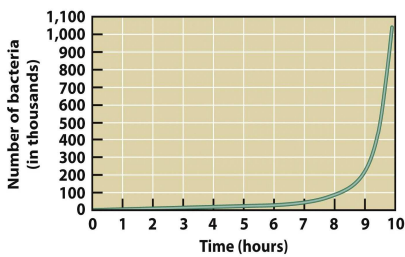
Exponential Growth



Exponential Growth

- Biotic Potential – the maximum reproductive capacity of a population if resources are unlimited. (The growth rate under ideal conditions).
- This leads to a J- Shaped Curve of exponential growth

Time (hours)	Number of bacteria
0	1
0.5	2
1.0	4
1.5	8
2.0	16
2.5	32
3.0	64
3.5	128
4.0	256
4.5	512
5.0	1,024
5.5	2,048
6.0	4,096
6.5	8,192
7.0	16,384
7.5	32,768
8.0	65,536
8.5	131,072
9.0	262,144
9.5	524,288
10.0	1,048,576



Biotic Potential isn't realistic because of limiting factors.

St. Matthew's Island reindeer population crash.

- Overshooting carrying capacity can lead to population crash
- Abrupt decline in population density – causes?

Year	Population Size
1944	29
1950	1,350
1966	6,000
1966	42

Logistical Growth Model

Logistical growth

- makes an S curve
- exponential growth then the rate slows down until the population reaches the carrying capacity (K)

Carrying Capacity (K) – maximum number that an environment can support.

Variations of the Logistic Model

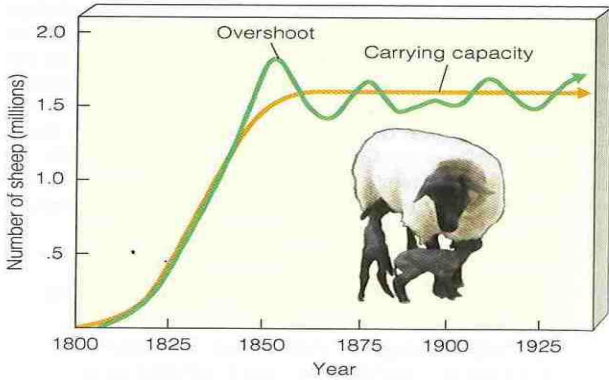
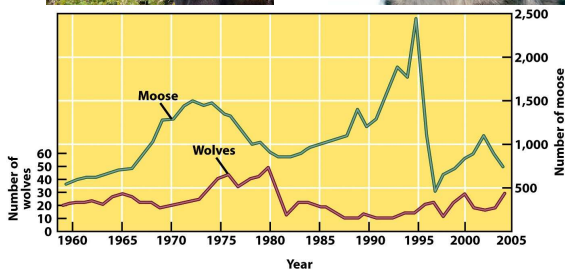


Figure 8-4: Sheep introduced on island of Tasmania in 1800

Natural Population Fluctuations

Contrary to hyped up media reports, some Obama supporters are having second thoughts.

Population Fluctuation Case Study- Isle Royale



The End (Happy Thanksgiving)



Did this already this year.

Exponential Growth in Australia



Calculate Population Density

- It has been stated that everyone in the United States could live comfortably inside the State of Texas. The 2010 population of the United States was 307 million people. The area of Texas is 260,000 mi². Assuming that the entire population of the US did move to Texas, what would be the population density per mi²?
- 307,000,000 people / 260,000 mi² / = people/mi²
- Fresno's Pop. Density - 500,000 people in 105 mi²
- 500,000 people /105 mi² = 4,784 people/mi²
- New York City Pop. Density- 8,200,000 people in 489 mi²
- 8,200,000 people / 489 mi² = 17,599 people/mi²
