Chapter 5

Populations and Communities

The marine iguana and the Sally lightfoot crab live on the Galápagos Islands in the Pacific Ocean.

The Sally lightfoot crab is a scavenger and will feed on just about anything, including dead skin.

The marine iguana is the only true saltwater lizard. It is an excellent swimmer and feeds on marine algae.
Chapter 5 Section 1: Populations & Communities

Key Vocabulary Terms

Adapted from Holt Biology 2008
Population

A group of organisms of the same species that live in a specific geographical area

Adapted from Holt Biology 2008
Carrying Capacity

The largest population that an environment can support at a given time

Adapted from Holt Biology 2008
Content Objectives

I will be able to identify:

• The importance of studying populations.

• The difference between exponential & Logistic growth.

• The factors that affect population size.

• How science & technology have affected human population growth.

Adapted from Holt Biology 2008
Chapter 5
Section 1:
Populations & Communities
Notes

Adapted from Holt Biology 2008
Chapter 5
Section 1: Populations & Communities

What is a Population?

Adapted from Holt Biology 2008
YOUR TURN
Active Reading
Section 1 – Populations?
Characteristics of Populations:

Geographic Distribution (range) : where the organisms live.

Adapted from Holt Biology 2008
Characteristics of Populations:

Population Density: the number of individuals per unit area.

Adapted from Holt Biology 2008
Characteristics of Populations:

Growth Rate

Adapted from Holt Biology 2008
THINK, SHARE, WRITE
TSW #1

What distinguishes one zebra population from another zebra population?
What distinguishes one zebra population from another zebra population?

A Zebra population consists of a group of zebras that live together and interbreed. A different zebra population lives separately from the other population and does not interbreed with that population.
Chapter 5
Section 1: Populations & Communities

Population Growth

Adapted from Holt Biology 2008
Four factors that affect population size

- Number of births
- Number of deaths
- Immigration
- Emigration

Adapted from Holt Biology 2008
Population Growth

Occurs when the individuals in a population reproduce at a constant rate.

Adapted from Holt Biology 2008
Population Growth Curves

Under **ideal conditions** with **unlimited resources**, a population will grow **exponentially**.

Adapted from Holt Biology 2008
Population Growth Curves

Exponential growth is also known as J-shaped.

Adapted from Holt Biology 2008
Exponential Growth

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Adapted from Holt Biology 2008
What are the characteristics of a population that grows exponentially?
What are the characteristics of a population that grows exponentially?

A population that grows exponentially grows slowly when it is small but grows quickly as it gets larger. An exponential growth curve is kind of in a “J” shape.
Logistic Growth

Occurs when a population’s exponential growth slows or stops.

Adapted from Holt Biology 2008
WHY Logistic Growth?

Resources get used up…

Adapted from Holt Biology 2008
Population Growth Curves

Logistic Growth – S Curve

Adapted from Holt Biology 2008
Population Growth Curves

Adapted from Holt Biology 2008
Complete the “analysis for the Quick Lab - “Population Growth”
Chapter 5
Section 1:
Populations & Communities

Factors That Affect Population Size

Adapted from Holt Biology 2008
GROWTH LIMITS

Different factors limiting population growth: BIOTIC or ABIOTIC.
GROWTH LIMITS

Limiting Factors: a situation that causes a decrease in population growth.

Adapted from Holt Biology 2008
Density-dependent limiting factors:

Factors that depend on population size.

Examples: competition, predation, disease

Adapted from Holt Biology 2008
Density-independent limiting factors:

Factors that affect ALL populations, regardless of size.

Examples: weather, natural disasters, humans

Adapted from Holt Biology 2008
Describe the differences between biotic and abiotic factors.
Describe the differences between biotic and abiotic factors.

Biotic factors are living factors that affect a population’s growth. Abiotic factors are nonliving factors that affect a population’s growth.
Chapter 5
Section 1: Populations & Communities

Human Population
Historical Overview of Human Population Growth

For much of human history, the population grew very SLOWLY.

Adapted from Holt Biology 2008
Historical Overview of Human Population Growth

About 500 years ago, the human population started growing MUCH FASTER.

Adapted from Holt Biology 2008
HUMAN POPULATION

- Old Stone Age
- New Stone Age
- Bronze Age
- Iron Age
- Middle Ages
- Modern times

Billions of people

- Start of agriculture
- Revolution
- Domestication
- Of animals
- And plants

Years:
- 9000 B.C.
- 7000 B.C.
- 5000 B.C.
- 3000 B.C.
- 1000 B.C.
- 1000 A.D.
- 1995 A.D.
HUMAN POPULATION

Adapted from Holt Biology 2008
Predictions

Some scientists think that in 50 years, the population will grow to 9 billion.

Source: U.S. Census Bureau, International Data Base, December 2008 Update.

Adapted from Holt Biology 2008
HUMAN POPULATION

World Population Growth


Adapted from Holt Biology 2008
Demography

The statistical study of human populations.
Demographic Transition

The tendency for a population’s birth and death rates to slow down.

CAUSES??

Adapted from Holt Biology 2008
Age Structure Diagrams

(Population profile) This shows the number of *females* and *males* within different age groups.

Adapted from Holt Biology 2008
Demography:
Age Structure Diagram

- Rapid Growth: Kenya, Nigeria, Saudi Arabia
- Slow Growth: United States, Australia, Canada
- Zero Growth: Denmark, Austria, Italy
- Negative Growth: Germany, Bulgaria, Hungary
THINK, SHARE, WRITE, (TSW) #4

How have advances in technology allowed the human population to grow faster?
How have advances in technology allowed the human population to grow faster?

By improving sanitation, controlling disease, and allowing for more efficient production of food.
Chapter 5 Section 2: Interactions in Communities

Key Vocabulary Terms

Adapted from Holt Biology 2008
Predation

An interaction between two organisms in which one organism (the *predator*) kills another (the *prey*)

Adapted from Holt Biology 2008
Coevolution

The evolution of two or more species that is due to mutual influence

Adapted from Holt Biology 2008
Parasitism

A relationship between two species where one benefits (the parasite) and the other species is harmed (the host)

Adapted from Holt Biology 2008
Symbiosis

A relationship in which two organisms live in close association
Mutualism

A type of symbiosis where both organisms benefit

Adapted from Holt Biology 2008
Commensalism

A type of symbiosis where one organism benefits and the other is neither helped nor harmed.

Adapted from Holt Biology 2008
Content Objectives

I will be able to identify:

• How predator-prey interactions influence both predators and prey.
• Five other types of interactions in a community.

Adapted from Holt Biology 2008
Chapter 5 Section 2: Interactions in Communities
Chapter 5 Section 2: Interactions in Communities

Predator-Prey Interactions

Adapted from Holt Biology 2008
Predator-Prey Relationships

Species in various relationships develop adaptations in response to one another. - coevolution

Adapted from Holt Biology 2008
When prey increases so does the predator, but when this occurs the prey decreases and then again the predators decrease too causing the prey to increase again. This is a negative feedback mechanisms leading to the stability or regulation of the population.
Figure 9-3. Changes in the abundance of the lynx and the snowshoe hare, as indicated by the number of pelts received by the Hudson’s Bay Company. This is a classic case of cyclic oscillation in population density. (Redrawn from MacLulich 1937.)
YOUR TURN
Active Reading
Section 2 – Interactions in Communities
Figure 9-3. Changes in the abundance of the lynx and the snowshoe hare, as indicated by the number of pelts received by the Hudson's Bay Company. This is a classic case of cyclic oscillation in population density. (Redrawn from MacLulich 1937.)
Other Interactions – 5 total

1. **Parasitism** – parasite is usually smaller than the host and relies on the host for food and shelter

Adapted from Holt Biology 2008
Other Interactions

2. **Herbivory** – herbivores consuming plants

Coevolution examples

Adapted from Holt Biology 2008
3. Mimicry

Adapted from Holt Biology 2008
Complete Quick Lab - The Effects of Herbivores on a Plant Species

1. Examine the illustrations.
2. Complete the “Analysis”.
Identify one way in which herbivores and plants coevolve.
Identify one way in which herbivores and plants coevolve.

Plants develop chemical compounds to make the plants taste terrible to herbivores. The herbivores develop defenses against the toxic compounds so that they may eat the plants.
4. Mutualism & 5. Commensalism

Adapted from Holt Biology 2008
Compare mutualism and commensalism.
Compare mutualism and commensalism.

Mutualism is a relationship in which both species benefit. Commensalism is a relationship in which one species benefits and the other species may not benefit but is not harmed.
Chapter 5 Section 3: Shapping Communities

Key Vocabulary Terms

Adapted from Holt Biology 2008
Niche

The unique position occupied by a species, both in terms of its physical use of its habitat and its function within an ecological community

Adapted from Holt Biology 2008
Fundamental niche

The largest ecological niche where an organism or species can live without competition

Adapted from Holt Biology 2008
Realized Niche

The range of resources that a species uses, the conditions that the species can tolerate, and the functional roles that the species plays as a result of competition in the species’ fundamental niche.

The actual niche with respect to other organisms in the community.

Adapted from Holt Biology 2008
Competitive Exclusion

The exclusion of one species by another due to competition

Adapted from Holt Biology 2008
Keystone species

A species that is critical to the function of the ecosystem in which it lives because it affects the survival and abundance of many other species in its community
Content Objectives

• I will be able to identify how a species' niche affects other organisms.
• I will be able to identify how competition for resources affects species in a community.
• I will be able to identify what factors influence resiliency of an ecosystem.
Language objectives

• I will complete a vocabulary graphic organizer on key terms associated with the shaping of communities and write definitions “in my own words”.

• I will ponder questions about how communities are shaped, write my thoughts down in my notes, and share/discuss my ideas with a partner and the class.

• I will record notes about interactions in communities based on PowerPoint presentation & class discussion.
Chapter 5 Section 3: Shaping Communities

Notes

Adapted from Holt Biology 2008
Chapter 5 Section 3: Shaping Communities

Carving a Niche

Adapted from Holt Biology 2008
How is a niche different from a habitat?

A niche is a role or function of a species within a community. The habitat is where the species live.

Adapted from Holt Biology 2008
Complete Quick Lab - Changes in a Realized Niche

1. Examine the Graph.
2. Complete the “Analysis”.
Competing for Resources

Why do organisms rarely occupy their entire fundamental niche?

Organisms interact with many others within the environment.

Adapted from Holt Biology 2008
THINK, SHARE, WRITE, (TSW) #7

Why do organisms rarely occupy their entire fundamental miche?
Why do organisms rarely occupy their entire fundamental niche?

Because they usually have to compete with other species for limited resources.
Competitive Exclusion

What is a non-native or introduced species?

A species that immigrates from another area

Adapted from Holt Biology 2008
Dividing Resources

Resources: food shelter
Organisms may feed slightly differently.

Adapted from Holt Biology 2008
How might two different species divide resources?
How might two different species divide resources?

By feeding in slightly different ways or in slightly different areas.
Keystone species

A species that is critical to the function of the ecosystem in which it lives because it affects the survival and abundance of many other species in its community

Adapted from Holt Biology 2008
Keystone

KEYSTONE SPECIES
Predation and Competition

Predators can influence more than one prey.

Predation can reduce competition.
Predation and Competition

Interactions between organisms help keep numbers in check.

Why is the otter a keystone species?

Adapted from Holt Biology 2008
YOUR TURN
Active Reading
Section 3 – Shaping Communities
Biodiversity and Resiliency

Community A has 50 species. Community B has 100 species. Which community would be more likely to survive change?

Adapted from Holt Biology 2008
Biodiversity and Resiliency

Predation can help increase biodiversity. Sea star and mussel

Adapted from Holt Biology 2008
List two factors that contribute to resiliency of an ecosystem.
List two factors that contribute to resilience of an ecosystem.

- Competition between species (Interaction).
- High Biodiversity (Number of Species).