Topic 3.1

Generalist and Specialist Species

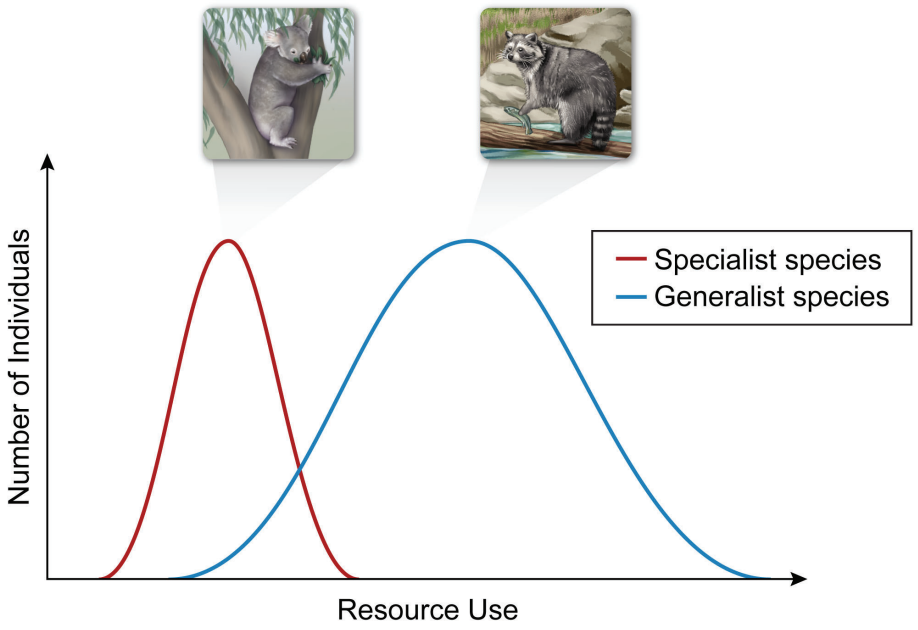
You Will Learn to:

- Describe the characteristics of generalist and specialist species and how they differ.

By the End of the Topic, You Should Be Able to Answer:

- What is an ecological niche?
- What are the two main categories of species based on their ecological niches?
- How do changing habitats impact different species?

Ecological Niches



Every organism within an ecosystem has an **ecological niche**, or role that the organism plays based on the environmental conditions and resources it requires for survival. Based on their niches and characteristics, organisms are typically classified as either **generalists** (species that can survive in a variety of environmental conditions) or **specialists** (species that require specific environmental conditions to survive).

Characteristics of Generalists	Characteristics of Specialists
• Have broad ecological niches • Have larger populations with more genetic variation • Are adaptable to many environments • Use a variety of resources	• Have narrow ecological niches • Have smaller populations with less genetic variation • Are adapted to a few specialized environments • Use a specific set of resources

Because specialists have specific environmental needs, they are not always able to adapt to environmental changes and tend to be advantaged in stable habitats. When habitats change, generalists tend to be more advantaged than specialists because they can adapt to a variety of environmental conditions.

For example, koalas are specialists that primarily survive on eucalyptus trees and do not survive in environments without that specific resource. In contrast, raccoons are generalists that eat a variety of plants and animals, which allows them to survive in most environments.

Things to Remember

- Based on their ecological niches, organisms can be categorized as either specialists or generalists. Specialist species tend to be advantaged in habitats that remain constant, whereas generalist species tend to be advantaged in habitats that change.

3.1 Vocabulary

Ecological niche	The role that an organism plays based on the environmental conditions and resources it requires for survival.
Generalist species	Species that can survive in a variety of environmental conditions and tend to not be affected by changing habitats.
Specialist species	Species that require specific environmental conditions to survive and tend to primarily thrive in stable, unchanging habitats.

3.1 Check for Understanding

1. **How is an organism's ecological niche determined?**

   A. By the organism's role in the environment

   B. By the organism's age

   C. By the organism's genetic and habitat diversity

   D. By the organism's primary productivity level

2. **Which of the following is the best example of a specialist species?**

   A. Cockroach, because they have a broad ecological niche

   B. Mouse, because they are adapted to various climates

   C. Panda, because they primarily consume bamboo

   D. Dandelion, because they grow in many soil types

3. **How are species impacted by gradual environmental changes?**

   A. Specialist populations increase while generalist populations remain the same.

   B. Specialist populations decrease while generalist populations remain the same.

   C. Specialist populations increase while generalist populations significantly decrease.

   D. Specialist populations decrease while generalist populations significantly increase.

Topic 3.2

K-Selected and r-Selected Species

You Will Learn to:

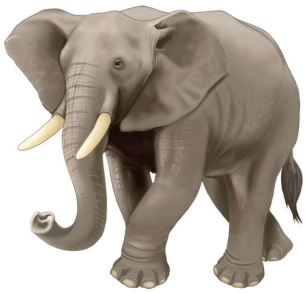
- Identify and compare the reproductive strategies of K- and r-selected species.

By the End of the Topic, You Should Be Able to Answer:

- What are the main types of reproductive strategies?
- What are the differences between K-selected and r-selected species?
- What is biotic potential?

Reproductive Strategies

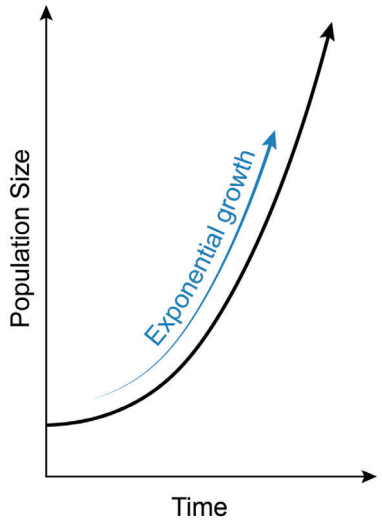
Most species can be categorized based on their **reproductive strategies** (how species have and raise offspring) that impact their reproductive success and long-term survival.

Characteristics of Reproductive Strategies	
K-selected	**r-selected**
	
• Consist of large organisms • Have long life expectancies • Mature late in life • Produce few offspring per reproduction event • Reproduce more than once in their lifetime • Require extensive parental care • Experience high levels of competition in their habitat • Are typically specialists	• Consist of small organisms • Have short life expectancies • Mature early in life • Produce many offspring per reproduction event • Reproduce only once in their lifetime • Require minimal parental care • Experience low levels of competition in their habitat • Are typically generalists

Because r-selected species have many offspring in a short period of time, can survive in various environments, and consume a vast number of resources, these species are more likely to become invasive and can outcompete other species for resources. As a result, most invasive species are considered r-selected.

Although some species follow only one of these two reproductive strategies, many species have both K- and r-selected characteristics or have characteristics that change throughout their lives. For example, American alligators mature late in life, reproduce multiple times in their lifetime, and have long life expectancies, which are K-selected characteristics, but they also have many offspring per reproduction event and require minimal parental care, which are r-selected characteristics.

Biotic Potential



The reproductive success of K- or r-selected species is dependent on many factors, including the availability of resources in their habitat. When either type of species is allowed to reproduce in a habitat with ideal conditions, such as having a surplus of food, no predators, and a lack of disease, their population can achieve **biotic potential** (the maximum reproductive rate of a population in ideal conditions). When this maximum population growth is graphed, it forms a J-shaped curve due to the exponential growth.

However, most populations are not able to continuously grow at a maximum rate, due to changing environmental conditions, decreased resource availability, and interactions with other species. For example, when invasive species are introduced into an ecosystem, the K-selected species tend to be more negatively affected than r-selected species due to the faster reproductive rates of r-selected organisms.

Things to Remember

- K-selected species are typically large organisms that live in stable environments, mature later in life, have long lifespans, face high competition for resources, have few offspring per reproduction event, and spend significant time raising their young.
- An r-selected species typically consists of small organisms that produce many offspring during one reproduction event, require minimal parental care, mature early in life, have a short life span, and experience minimal competition for resources.
- Invasive species tend to affect K-selected species more negatively than r-selected species. Because of their traits, many invasive species are considered r-selected.
- Many species exhibit traits of both r- and K-selected species.
- Biotic potential is defined as the maximum reproductive rate of a population under ideal conditions—sufficient food supply, no predators, and lack of disease.

3.2 Vocabulary

Biotic potential	The maximum reproductive rate of a population in ideal conditions.
K-selected species	Large organisms that live in stable environments, mature later in life, have long lifespans, face high competition for resources, have few offspring per reproduction event, and spend a significant time raising their young.
Reproductive strategies	How species have and raise offspring.
r-selected species	Small organisms that mature early in life, have short lifespans, experience minimal competition for resources, have many offspring during one reproduction event, and spend minimal time caring for their young.

3.2 Check for Understanding

1. **Which of the following characteristics is associated with r-selected species?**
   A. Small number of offspring
   B. Short life expectancy
   C. Organisms that are large in size
   D. Multiple reproductive events

2. **Polar bears have which of the following reproductive strategies?**
   A. Biotic potential
   B. Invasive
   C. K-selected
   D. r-selected

3. **Which of the following defines biotic potential?**
   A. The maximum growth rate under ideal environmental conditions
   B. The minimum growth rate under ideal environmental conditions
   C. The maximum number of organisms an ecosystem can support
   D. The minimum number of organisms an ecosystem can support