



Lesson Overview

6.1 Habitats, Niches
and Species
Interactions

THINK ABOUT IT

If you ask someone where an organism lives, that person might answer “on a coral reef” or “in the desert.”

These answers give the environment or location, but ecologists need more information to understand fully why an organism lives where it does and how it fits into its surroundings.

What else do they need to know?

The Niche



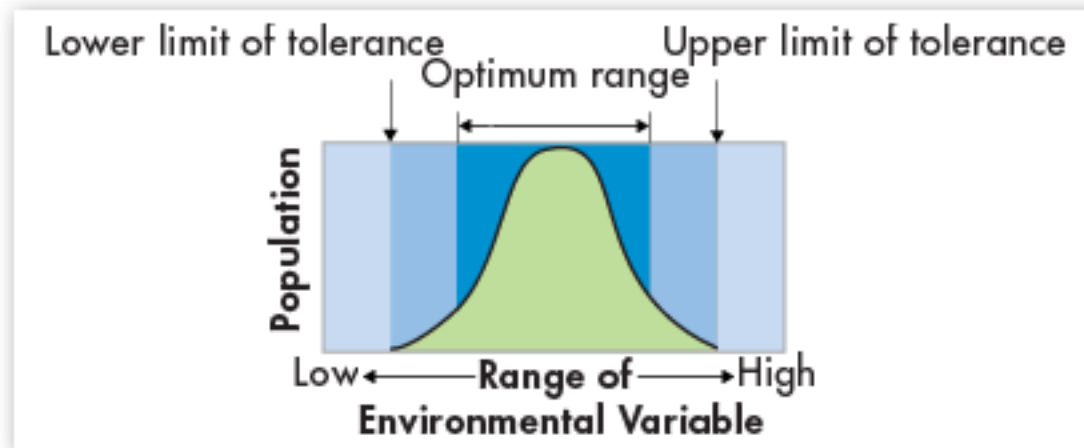
What is a niche?



A niche is the range of physical and biological conditions in which a species lives and the way the species obtains what it needs to survive and reproduce.

Tolerance

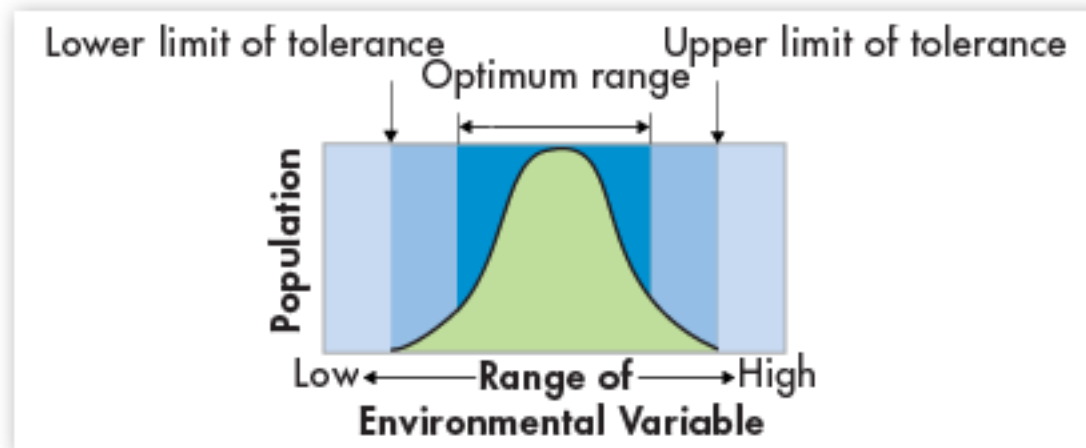
Every species has its own range of **tolerance**, the ability to survive and reproduce under a range of environmental circumstances.



Tolerance

When an environmental condition, such as temperature, extends in either direction beyond an organism's optimum range, the organism experiences stress.

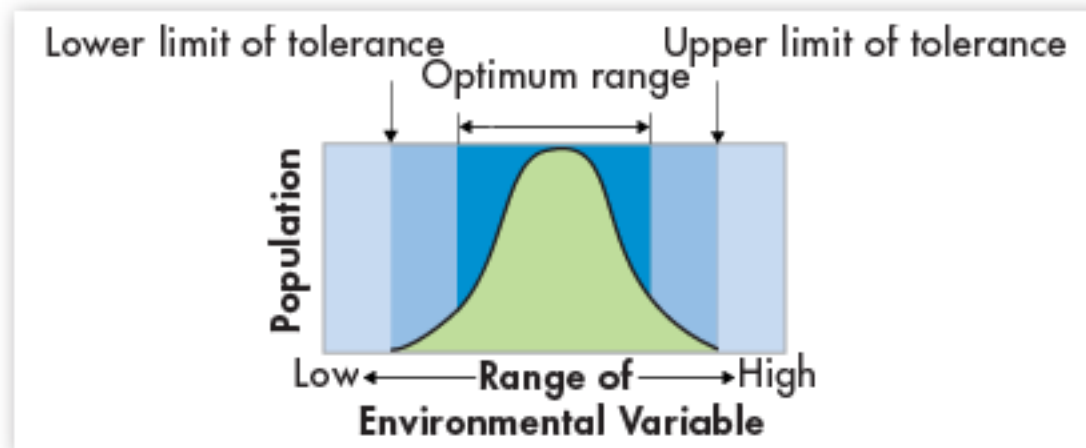
The organism must expend more energy to maintain homeostasis, and so has less energy left for growth and reproduction.



Tolerance

Organisms have an upper and lower limit of tolerance for every environmental factor. Beyond those limits, the organism cannot survive.

A species' tolerance for environmental conditions, then, helps determine its **habitat**—the general place where an organism lives.



Defining the Niche

An organism's **niche** describes not only the environment where it lives, but *how* it interacts with biotic and abiotic factors in the environment.

In other words, an organism's niche includes not only the physical and biological aspects of its environment, but also the way in which the organism uses them to survive and reproduce.

Resources and the Niche

The term **resource** can refer to any necessity of life, such as water, nutrients, light, food, or space.

For plants, resources can include sunlight, water, and soil nutrients.

For animals, resources can include nesting space, shelter, types of food, and places to feed.

Physical Aspects of the Niche

Part of an organism's niche involves the abiotic factors it requires for survival.

Most amphibians, for example, lose and absorb water through their skin, so they must live in moist places.

If an area is too hot and dry, or too cold for too long, most amphibians cannot survive.

Biological Aspects of the Niche

Biological aspects of an organism's niche involve the biotic factors it requires for survival, such as when and how it reproduces, the food it eats, and the way in which it obtains that food.

Birds on Christmas Island in the Indian Ocean, for example, all live in the same habitat but they prey on fish of different sizes and feed in different places.

Thus, each species occupies a distinct niche.

Competition



How does competition shape communities?



By causing species to divide resources, competition helps determine the number and kinds of species in a community and the niche each species occupies.

Competition

How one organism interacts with other organisms is an important part of defining its niche.

Competition occurs when organisms attempt to use the same limited ecological resource in the same place at the same time.

Competition

In a forest, for example, plant roots compete for resources such as water and nutrients in the soil.

Animals **compete** for resources such as food, mates, and places to live and raise their young.

Competition can occur both between members of the same species (known as intraspecific competition) and between members of different species (known as interspecific competition).

The Competitive Exclusion Principle

The **competitive exclusion principle** states that no two species can occupy exactly the same niche in exactly the same habitat at exactly the same time.

If two species attempt to occupy the same niche, one species will be better at competing for limited resources and will eventually exclude the other species.

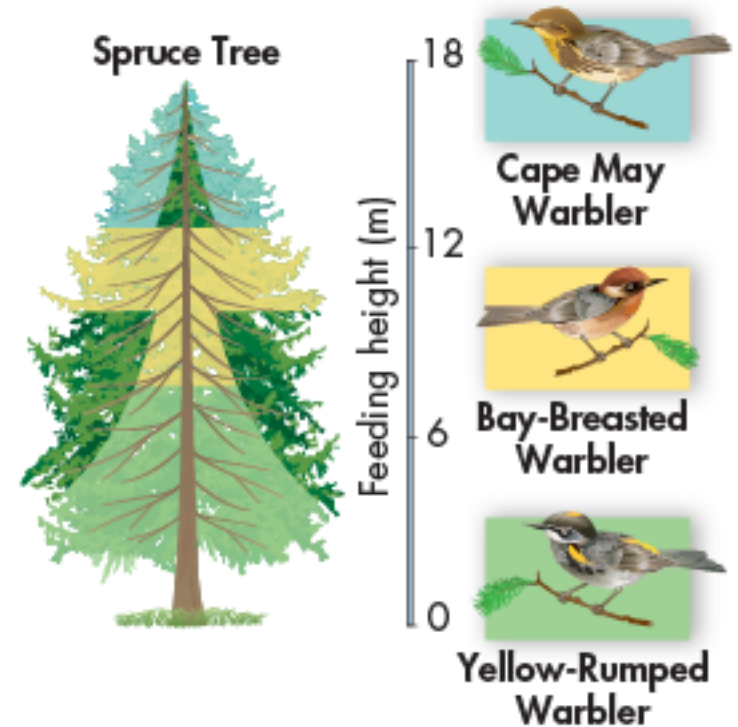
As a result of competitive exclusion, natural communities rarely have niches that overlap significantly.

Dividing Resources

Instead of competing for similar resources, species usually divide them.

For example, the three species of North American warblers shown all live in the same trees and feed on insects.

But one species feeds on high branches; another feeds on low branches, and another feeds in the middle.

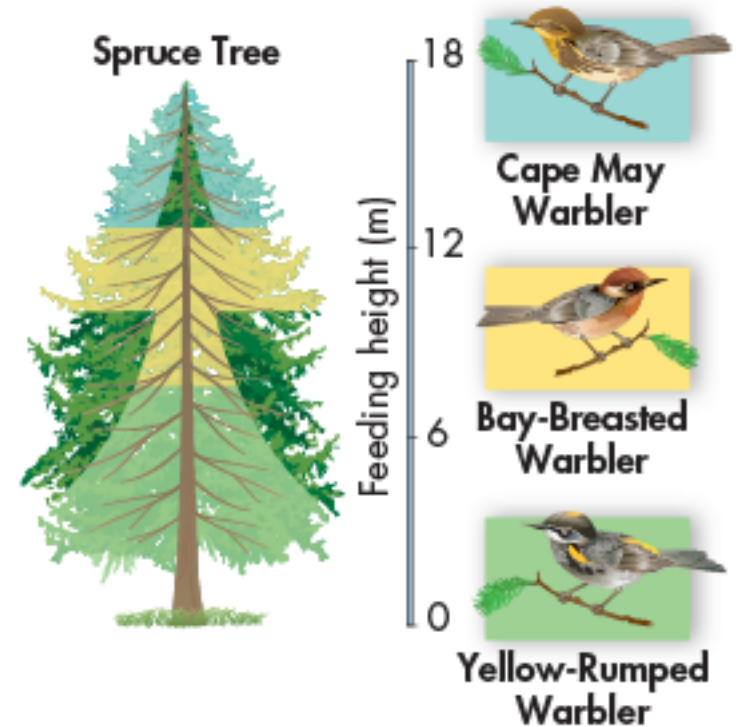


Dividing Resources

The resources utilized by these species are similar yet different. Therefore, each species has its own niche and competition is minimized.

This division of resources was likely brought about by past competition among the birds.

By causing species to divide resources, competition helps determine the number and kinds of species in a community and the niche each species occupies



Predation, Herbivory, and Keystone Species



How do predation and herbivory shape communities?



Predators can affect the size of prey populations in a community and determine the places prey can live and feed.



Herbivores can affect both the size and distribution of plant populations in a community and determine the places that certain plants can survive and grow.

Predator-Prey Relationships

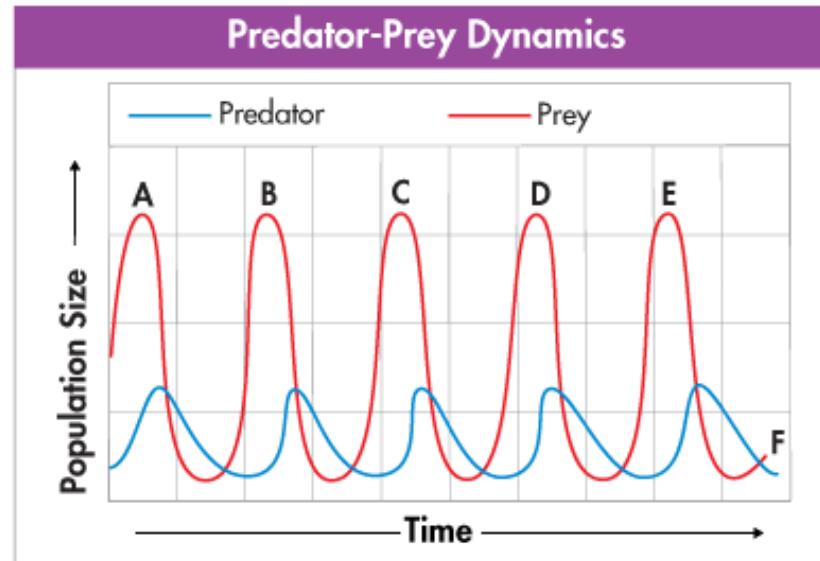
An interaction in which one animal (the predator) captures and feeds on another animal (the prey) is called **predation**.

Predators can affect the size of prey populations in a community and determine the places prey can live and feed.

Birds of prey, for example, can play an important role in regulating the population sizes of mice, voles, and other small mammals.

Predator-Prey Relationships

This graph shows an idealized computer model of changes in predator and prey populations over time.



Herbivore-Plant Relationships

An interaction in which one animal (the herbivore) feeds on producers (such as plants) is called **herbivory**.

Herbivores, like a ring-tailed lemur, can affect both the size and distribution of plant populations in a community and determine the places that certain plants can survive and grow.

For example, very dense populations of white-tailed deer are eliminating their favorite food plants from many places across the United States.

Keystone Species

Sometimes changes in the population of a single species, often called a **keystone species**, can cause dramatic changes in the structure of a community.

In the cold waters off the Pacific coast of North America, for example, sea otters devour large quantities of sea urchins.

Urchins are herbivores whose favorite food is kelp, giant algae that grow in undersea “forests.”

Keystone Species

A century ago, sea otters were nearly eliminated by hunting. Unexpectedly, the kelp forest nearly vanished.

Without otters as predators, the sea urchin population skyrocketed, and armies of urchins devoured kelp down to bare rock.

Without kelp to provide habitat, many other animals, including seabirds, disappeared.

Otters were a keystone species in this community.

Keystone Species

After otters were protected as an endangered species, their population began to recover.

As otters returned, the urchin populations dropped, and kelp forests began to thrive again.

Recently, however, the otter population has been falling again, and no one knows why.

Symbioses

Any relationship in which two species live closely together is called **symbiosis**, which means “living together.”

The three main classes of symbiotic relationships in nature are mutualism, parasitism, and commensalism.

Mutualism

The sea anemone's sting has two functions: to capture prey and to protect the anemone from predators. Even so, certain fish manage to snack on anemone tentacles.

The clownfish, however, is immune to anemone stings. When threatened by a predator, clownfish seek shelter by snuggling deep into an anemone's tentacles.

Mutualism

If an anemone-eating species tries to attack the anemone, the clownfish dart out and chase away the predators.

This kind of relationship between species in which both benefit is known as **mutualism**.

Parasitism

Tapeworms live in the intestines of mammals, where they absorb large amounts of their hosts' food.

Fleas, ticks, lice, and the leech shown, live on the bodies of mammals and feed on their blood and skin.

These are examples of **parasitism**, relationships in which one organism lives inside or on another organism and harms it.

Parasitism

The parasite obtains all or part of its nutritional needs from the host organism.

Generally, parasites weaken but do not kill their host, which is usually larger than the parasite.

Commensalism

Barnacles often attach themselves to a whale's skin. They perform no known service to the whale, nor do they harm it. Yet the barnacles benefit from the constant movement of water—that is full of food particles—past the swimming whale.

This is an example of **commensalism**, a relationship in which one organism benefits and the other is neither helped nor harmed.