

Biodiversity, Species Interactions, and Population Control

Chapter 5

Core Case Study: Southern Sea Otters: Are They Back from the Brink of Extinction?

- Habitat: North American Kelp Forests
- Hunted: early 1900s
- Partial recovery
- Why care about sea otters?
 - Ethics
 - Keystone species
 - Tourism dollars

Southern Sea Otter



5-1 How Do Species Interact?

- **Concept 5-1** Five types of species interactions—*competition, predation, parasitism, mutualism, and commensalism*—affect the resource use and population sizes of the species in an ecosystem.

Most Consumer Species Feed on Live Organisms of Other Species (1)

- **Predators** may capture prey by
 - Walking
 - Swimming
 - Flying
 - Pursuit and ambush
 - Sit and wait
 - Camouflage
 - Chemical warfare

Most Consumer Species Feed on Live Organisms of Other Species (2)

- **Interspecific Adaptive Prey Strategies** may avoid capture by evolving *defense mechanisms* (Fig. 5-2):
 - Camouflage
 - Chemical warfare
 - Aposematic Warning coloration
 - Mimicry
 - Deceptive looks
 - Deceptive behavior

Predator Avoidance Strategies

(a) Span worm

(b) Wandering leaf insect

(c) Bombardier beetle

(d) Foul-tasting monarch butterfly

(e) Poison dart frog

(f) Viceroy butterfly mimics monarch butterfly

(g) Hind wings of Io moth resemble eyes of a much larger animal.

(h) When touched, snake caterpillar changes shape to look like head of snake.

© Brooks/Cole, Cengage Learning Fig. 5-2, p. 103

Batesian Mimicry

A noxious, or dangerous, organism (the model), equipped with a warning system such as conspicuous coloration, is mimicked by a harmless organism (the mimic). The mimic gains protection because predators mistake it for the model and leave it alone.

More Batesian mimicry

The flounder *Camitigaster valentini* (left) mimics the unpalatable puffer *Paralichthys reticulatus*

Hoverfly (mimic)

Honeybee

King Snake (mimic)

Coral Snake

(a) Hawkmoth larva

(b) Green parrot snake

Mullerian Mimicry

Two or more distasteful species, that may or may not be closely related and share one or more common predators, have come to mimic each other's warning signals. The predator learns to avoid all creatures that share these traits.

(a) Cuckoo bee

Yellow jacket

Viceroy Butterfly (mimic)

Monarch Butterfly

Unpalatable caterpillars of St. Jacobsbutterfly mimic stinging wasps and venomous coral snakes

Cryptic Camouflage – “Crypsis”

Concealing coloration, in animals, the use of biological coloration to mask location, identity, and movement, providing concealment from prey and protection from predators. Defense or predation.

Crypsis works only if the animal is resting on the appropriate background and usually only when the animal isn't moving.

Behavioral Mimicry

Hawkmoth larva

Green parrot snake

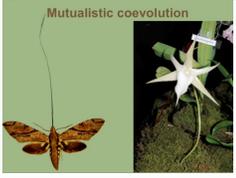
Predator and Prey Species Can Drive Each Other's Evolution

- Intense natural selection pressures between predator and prey populations
- Coevolution**
 - Bat hunting a moth

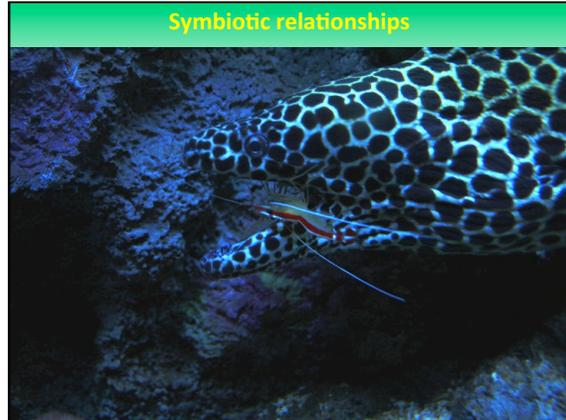
Coevolution: The process that occurs when two species evolve in response to each others influence.

For example, an insect may evolve specialized parts that allow it to feed on a specific flower, whereas the flower evolves to facilitate pollination by that particular insect.





Mutualistic coevolution



What is symbiosis?

- Symbiosis (from the Greek roots sym: “together with” and bio: “living”) is a close, prolonged association between organisms of different species that may benefit one or both members (parasitism; commensalism; mutualism).




Some Species Feed off Other Species by Living on or in Them

- Parasitism**
 - Parasite-host interaction may lead to coevolution




In Some Interactions, Both Species Benefit

- Mutualism**
 - Nutrition and protection relationship
 - Gut inhabitant mutualism




(a) Oxpeckers and black rhinoceros
© iStockphoto, George Fennell

(b) Clownfish and sea anemone

In Some Interactions, One Species Benefits and the Other Is Not Harmed

- Commensalism**
 - Man-of-war fish
 - Epiphytes
 - Birds nesting in trees




Evolutionary significance

- **Mutualism** and **commensalism** are hypothesized to have originated from **parasitic** relationships.
- If true, then host organisms, through evolutionary adaptation, selected traits that allowed them to take advantage of parasitic behavior, leading to mutually beneficial relationships in some cases.



Reef Cleaning Stations



5-2 How Can Natural Selection Reduce Competition between Species?

- **Concept 5-2** Some species develop adaptations that allow them to reduce or avoid competition with other species for resources.

Some Species Evolve Ways to Share Resources

- **Resource partitioning**
- Reduce niche overlap (Fig. 5-7)
- Use shared resources at different
 - Times
 - Places
 - Ways

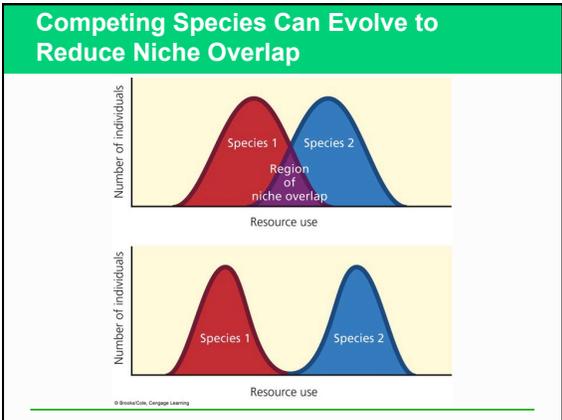


Fig. 5-8, p. 107

5-3 What Limits the Growth of Populations?

- **Concept 5-3** *No population can continue to grow indefinitely because of limitations on resources and because of competition among species for those resources.*