Chapter 27: community interactions

Why Are Community Interactions Important?

- The interactions among populations within a community
  - ❖ maintain a balance between available resources & the number of ***individuals using them***

- the interactions among the populations serve to limit population size
  - ❖ they lead to changes in characteristics and behaviors, increasing the ***fitness*** of the total population.
  - ❖
  - ❖ This is ***evolution***

Why Are Community Interactions Important?

- When changes in one species results in adaptive changes in an interacting species

  - ❖ ***coevolution*** has occurred

An orchid species that coevolved to look more like a female wasp to encourage more pollination visits from male wasps

What Are the Effects of Competition Among Species?

- _Competition_ **among species is** _interspecific competition_
  - ❖ **The effect on the species involved is so strong that each evolves ways to reduce any overlap in needs**
- **In other words, each species specializes within the community, developing its own well-defined,** _ecological niche_

Competitive exclusion principle

- Adaptations Reduce the Overlap of Ecological Niches Among Coexisting Species
  - ❖ one species would eventually go extinct without adaptations.

- The _Competitive Exclusion Principle_
 - ❖ no two species can inhabit the exact same ecological niche simultaneously & continuously.

Competitive exclusion principle

- Experiment that illustrated the competitive exclusion principle
  - ❖ Used two different paramecium species
    - ➤ _P. aurelia_ and _P. caudatum_
    - ➤ Both eat bacteria
  - ❖ When kept separately, both thrived on the bacteria.
  - ❖ When both species were kept in the same container, P. aurelia outcompeted P. caudatum
    - ➤ _P. caudatum_ went "extinct".

Competitive exclusion principle

So how do species in natural settings avoid extinction?
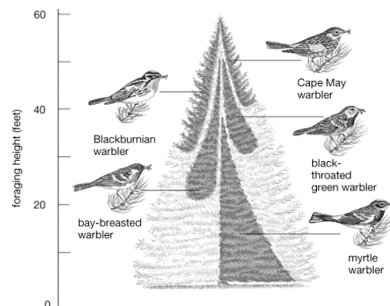
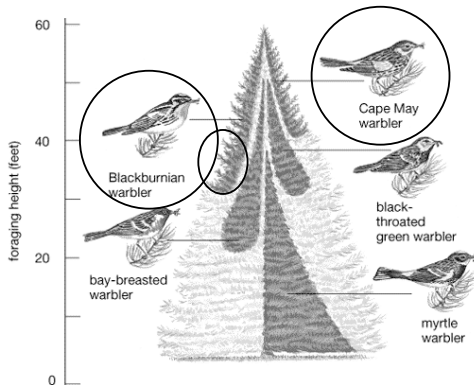Resource partitioning!
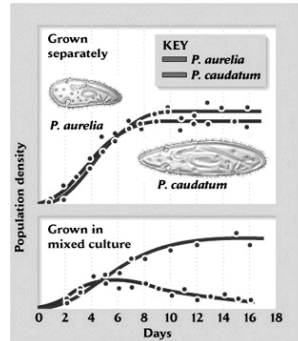
Resource Partitioning

- When two or more species with similar requirements coexist

they typically occupy a smaller niche than either would if by themselves.

Figure 27-2

Resource partitioning

Resource/range expansion

- **If one of the competing species is removed from the community**
  - ❖ **the other species may expand its niche since the competition pressure has been reduced.**

  - ❖ **The range is then reduced when the competitor is reintroduced.**
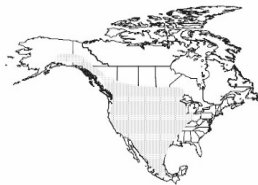

Natural example

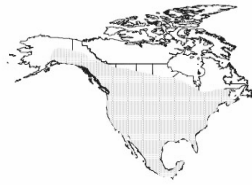Figure 3. Approximate distribution of coyote in North America 1900

Figure 2. Approximate distribution of coyote in North America 1990

**The coyote was able to expand its range when its main competitor, the gray wolf, was eliminated.**

What Are the Results of Interactions Between Predators and Their Prey?

- *Predation* **interactions have intense effects on the species involved**
  - ❖ **Predators have evolved ways to best capture their prey, while the prey have evolved mechanisms to elude their predators**

- **This** *coevolution* **has resulted in some very complex physical characteristics and behaviors**
  - ❖ **Know the examples of how they coevolve from your text!   Pgs 527 - 546**

Coevolution involving prey & predators

- **Bats and their moth prey have developed complex "cat and mouse" behaviors**
  - ❖**Counteracting behaviors**

- **Other species** *camouflage* **themselves to avoid predators or detection by prey (Figure 27-5, 27-6)**
  .
- **In contrast to camouflaged species, others stand out with bright or** *warning coloration* **(Figure 27-7)**

Figure 27-4
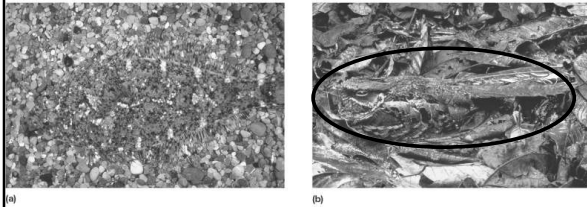
(a)   (b)
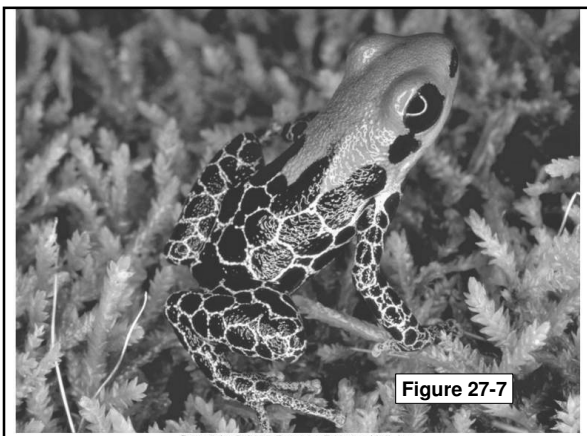
Figure 27-7

Warning coloration: Eat me and die

- **These species advertise their presence**

- **Their _warning coloration_ are bright colors**
  - ❖ **warn potential predators that they are poisonous or otherwise distasteful & are to be avoided**

- **Species with common characteristics may share warning patterns as well**
  - ❖ **Mullerian and Batesian mimicry**

More mimicry

- **"Devious" predators exists as well:**
  - ❖ **_Aggressive mimicry_ has evolved among species that resemble harmless species**
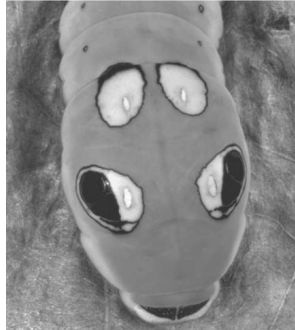

Startle coloration

- **Species use their** _startle coloration_ **to scare away predators**
  - ❖ **Some prey make use of color patterns that mimic a larger organism**

More startle mimicry

Caterpillar has coloration that makes it resemble a snake

**Reduces the likelihood of birds eating it.**

Chemical warfare

- **Some prey species have the ultimate defense: "***chemical warfare***"**

- Coevolution**, however, has also lead to a few predator species that are not harmed by the chemical produced**
  - ❖**may even use it as its own defense mechanism**

Chemical warfare

- Types of chemical warfare
  - ❖Snake and spider venoms

  - ❖Smokescreens by octopi, squid & sea slugs

  - ❖Toxic sprays
    - ➢Bombadier beetles
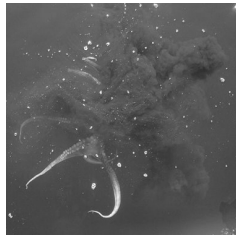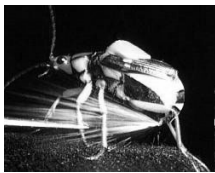
What Is Symbiosis?

- **Some species have such close interactions that they have developed _symbiotic_ relationships**

- **When one species of the relationship benefits and the other is unaffected, the relationship is**
  - ❖ **_Commensalistic_**
- **If one species benefits and the other is harmed, the relationship is ...**
  - ❖ **_Parasitic_**

- **If both species benefit, the relationship is**
  - ❖ **_mutualistic_**

Table **27-1** Interactions Among Organisms		
Type of Interaction	**Effect on Organism A**	**Effect on Organism B**
Competition between A and B	Harms	Harms
Predation by A on B	Benefits	Harms
Symbiosis		
Parasitism by A on B	Benefits	Harms
Commensalism of A with B	Benefits	No effect
Mutualism between A and B	Benefits	Benefits

Parasitism

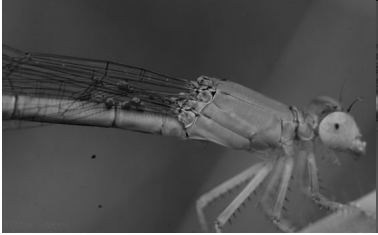

Parasitic protists (ich) infect tropical fish in aquariums

Hookworms infect through the feet in the southern US

Mistletoe steals nutrients from oak trees

commensalism

- Toughest to find in nature
  - ❖ Most commonly found are hitchhikers

Red mites are hitching a ride on this damselfly.

Mutualism

- Many examples

Share nutrients, protection

Share protection

Keystone species:
keystone to community structure

- **The influence of species on community structure is not necessarily equal**
  - ❖ **removal of keystone species drastically alter the community**
- **When one species has a role that is out of proportion to its population size, that species is a** *keystone* **in the community**

Example 1: *Pisaster* as a keystone species

- The sea star *Pisaster* helps maintain diversity in the middle intertidal zone
  - ❖ Without *Pisaster*, mussels overgrow the area
  - ❖ Outcompete all other invertebrates.

Keystone species

- **Often, a keystone species cannot be identified until it has actually been _removed from the community_**
  - ❖ **Extinctions have revealed a number of previously unknown keystone species**

- **At this point it may be too late to reduce the impact its absence will have on the community**

Keystone species

- Decline in otter populations in Alaska
  - ❖ Resulted in overabundance of sea urchins
  - ❖ Which resulted in decline of kelp beds
  - ❖ Which resulted in the decline of many marine species that lived in the kelp beds.

I do more than just look cute!
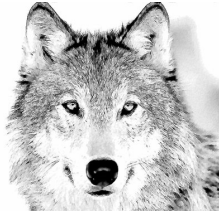
Keystone species

- Wolves
  - ❖ Elimination of wolves in Michigan led to
    - ➤ Overpopulation of white tailed deer
    - ➤ Which resulted in decline in brush species
    - ➤ Which resulted in less food for other herbivores
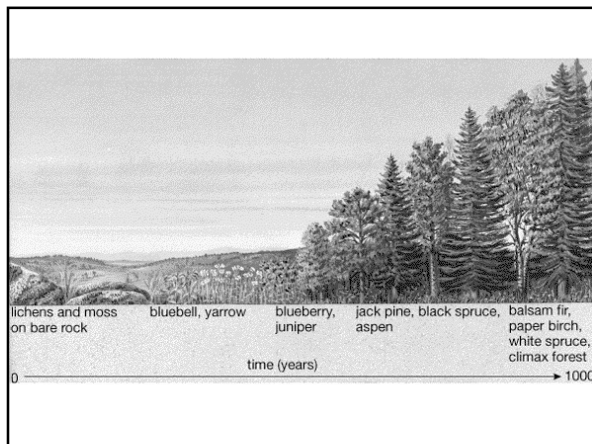   - ➤ Also led to increase in car-deer accidents.

Removal also led to increase in coyotes

Succession: How Do Community Interactions Cause Change over Time?

- **The interactions among members of a community lead to structural changes within that community;**
  - ❖ **changes that are identified as stages in _succession_ of the community**
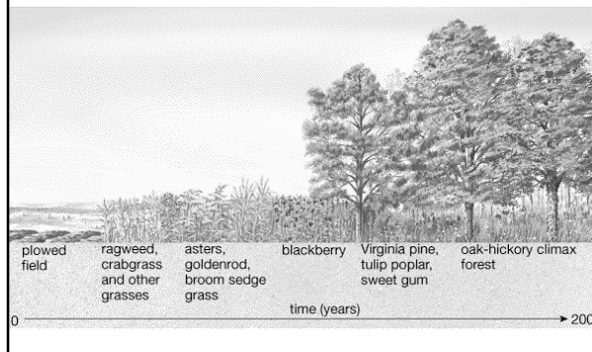- *Primary* succession **begins with** *pioneer* species **such as lichen and mosses establishing a hold on** bare rock

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lichens and moss on bare rock | bluebell, yarrow | blueberry, juniper | jack pine, black spruce, aspen | balsam fir, paper birch, white spruce, climax forest

time (years)

0 ➤ 1000

Succession

- **As soil slowly forms, additional species move into the young community in a recognizable pattern**
- *Secondary* succession **occurs after an established community has been disturbed perhaps by fire, wind storm, or farming**
- **If left undisturbed, succession will continue to a stable endpoint, the** *climax*, **determined in a large part by the geography and climate of the area**

Field succession

plowed field | ragweed, crabgrass and other grasses | asters, goldenrod, broom sedge grass | blackberry | Virginia pine, tulip poplar, sweet gum | oak-hickory climax forest

time (years)

0   ► 200

Mount St. Helens

Photo taken 5/24/09 shows that some succession has occurred since the 1980 eruption

Succession

- **If a community is regularly disturbed, it will be maintained at a succession point below the climax, a** *subclimax*

- **Climax communities covering broad geographical regions are** *biomes*

- **Biomes are distinguished by specific climatic conditions and characterized by specific plant communities**