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.

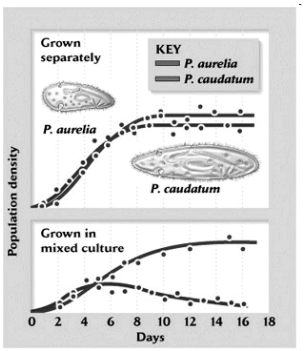
Competitive exclusion principle

- 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.

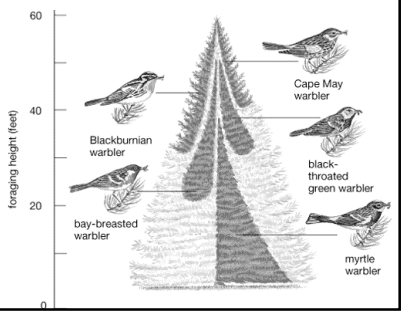
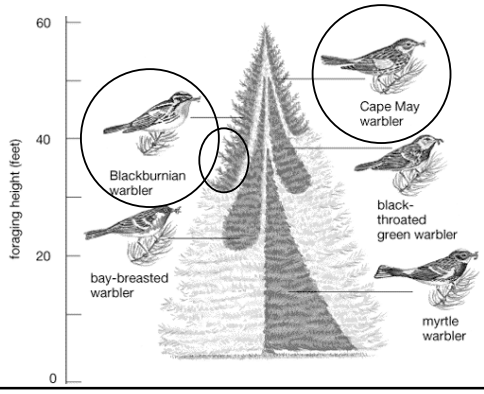


Figure 27-2

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

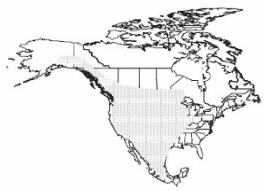


Figure 3. Approximate distribution of coyote in North America 1900

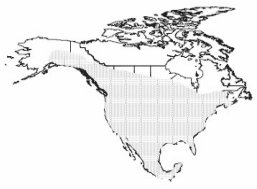


Figure 2. Approximate distribution of coyote in North America 1990

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

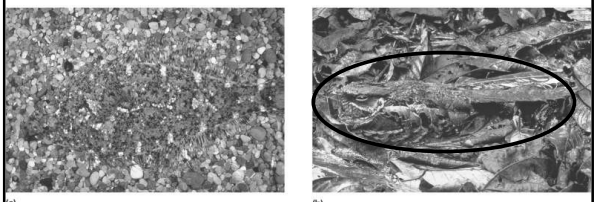
What Are the Results of Interactions Between Predators and Their Prey?

- *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



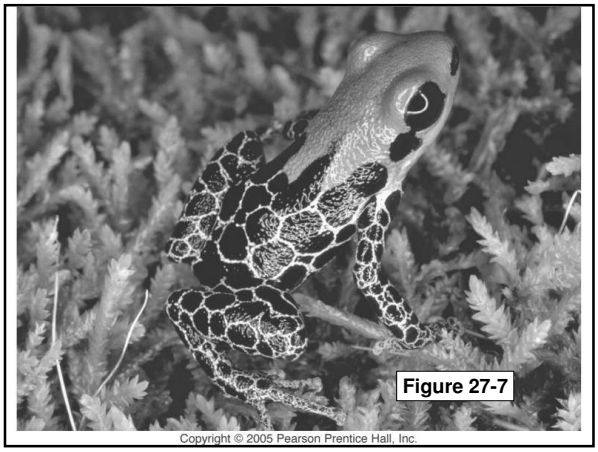
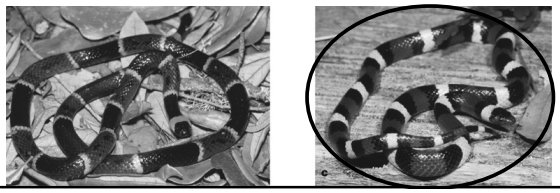


Figure 27-7

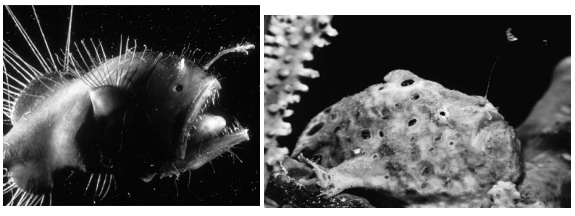
Warning coloration: Eat me and die

- **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**



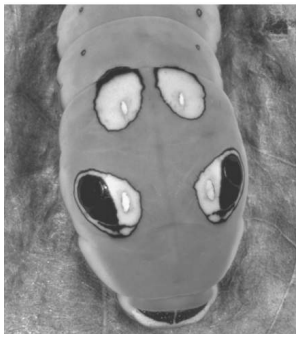
Startle coloration

- **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.

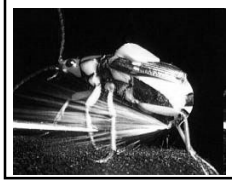


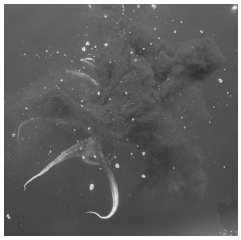
Chemical warfare

- **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

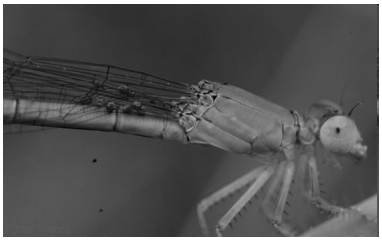
Mistletoe steals nutrients from oak trees

Parasitic protists (ich) infect tropical fish in aquariums

Hookworms infect through the feet in the southern US

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

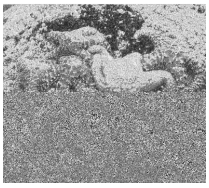
Share protection

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**

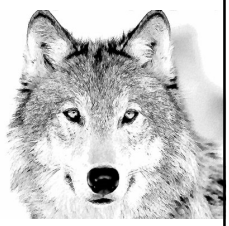
Keystone species

- 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

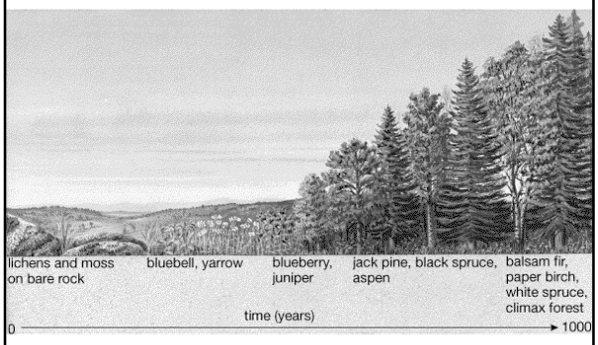
- Wolves
  - ❖Elimination of wolves in Michigan led to
    - ➢Overpopulation of white tailed deer
    - ➢Which resulted in decline in brush species
    - ➢Which resulted in less food for other herbivores
    - ➢Also led to increase in car-deer accidents.



Removal also led to increase in coyotes

Succession: How Do Community Interactions Cause Change over Time?

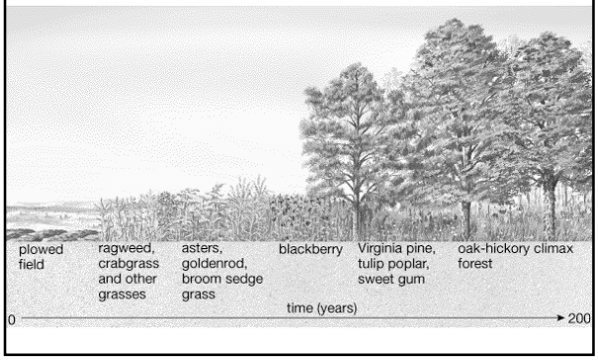
- **The interactions among members of a community lead to structural changes within that community;**
  - ❖**changes that are identified as stages in *succession* of the community**
- *Primary* succession **begins with** *pioneer* species **such as lichen and mosses establishing a hold on** bare rock



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



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**