Species interactions

Species interactions

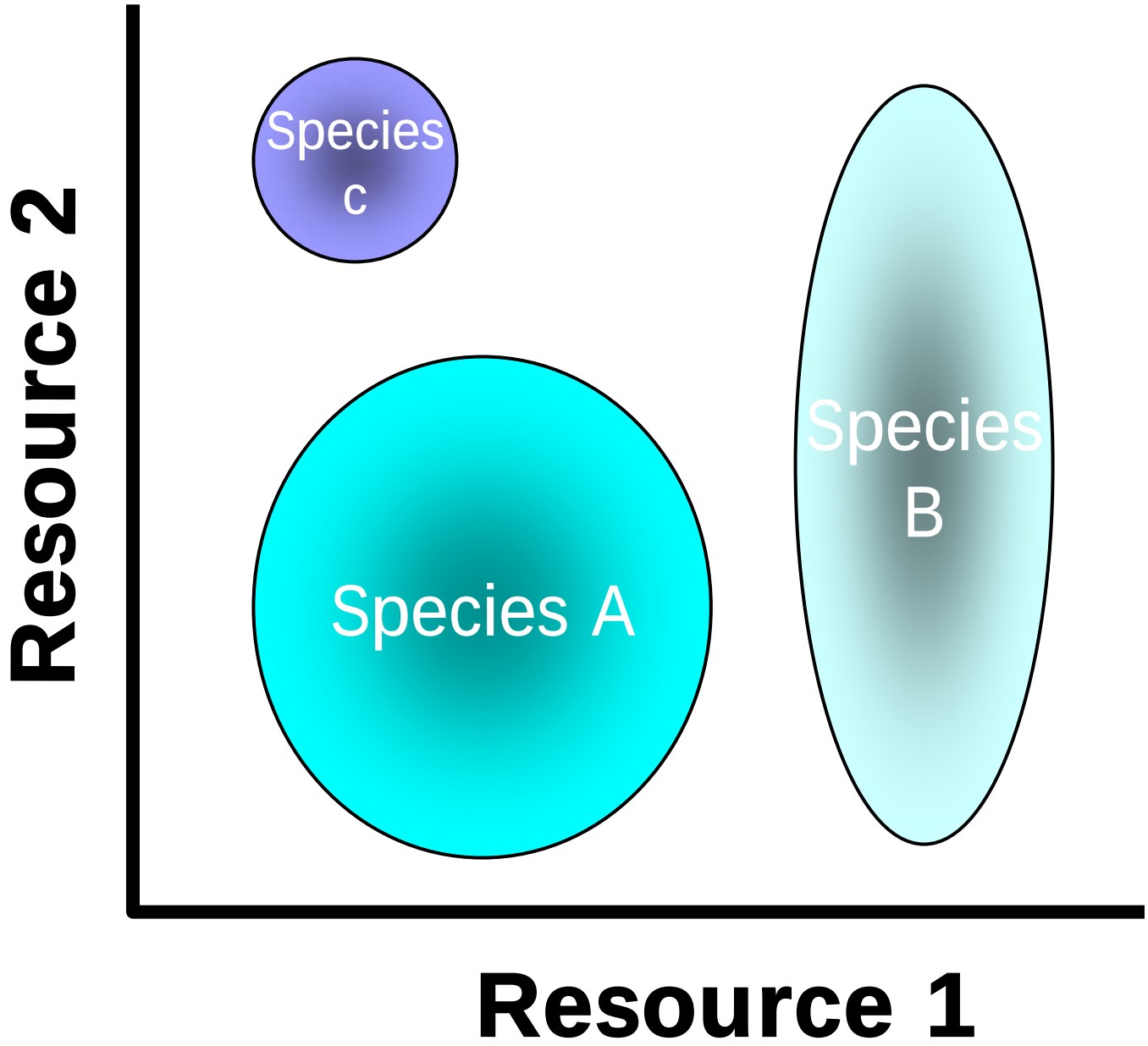
- Embedded within the realm of population and community ecology
  - Goal: understand how populations of interacting species reduce and/or regulate each other population density
  - Importance: they affect the abundance and distribution of species; they also provide the basis to understand how communities are assembled

Table 53.1 Interspecific Interactions

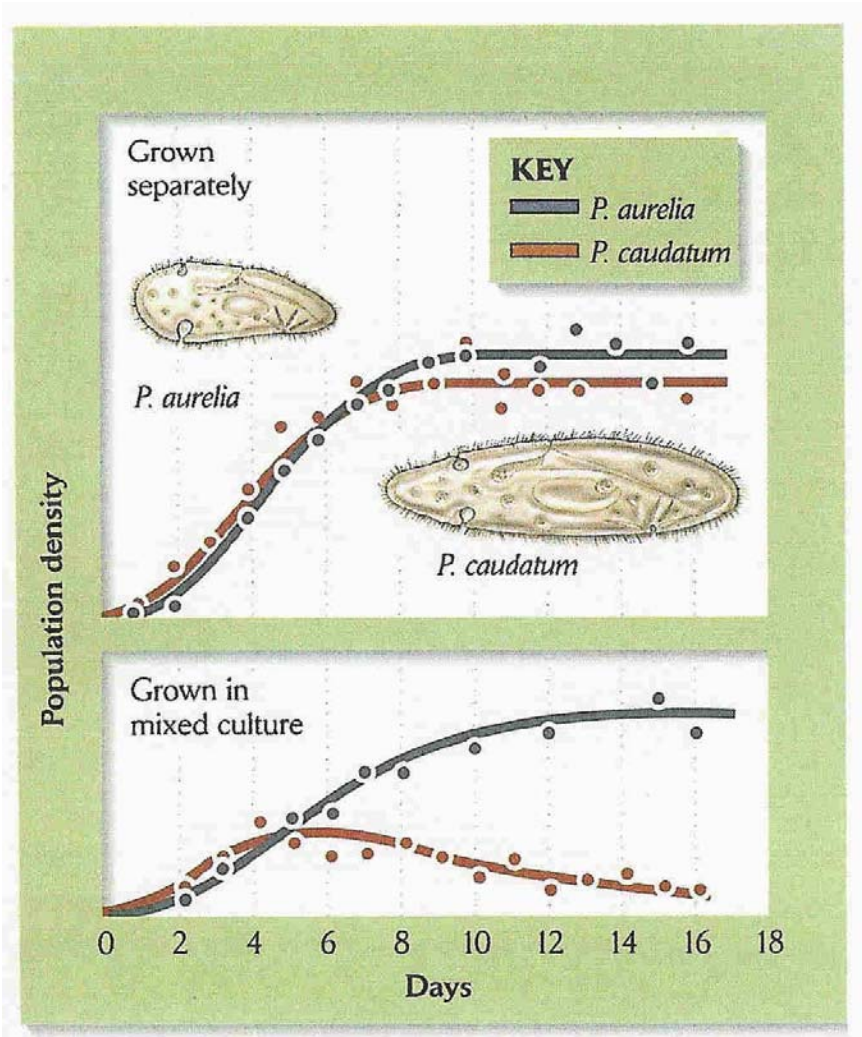
Interaction	Effects on Population Density
Competition (−/−)	The interaction is detrimental to both species.
Predation (+/−) (includes parasitism)	The interaction is beneficial to one species and detrimental to the other.
Mutualism (+/+)	The interaction is beneficial to both species.
Commensalism (+/0)	One species benefits from the interaction but the other is unaffected.

Competition

- Competition usually refers to interspecific competition for limiting resources
- Ecological niche: set of habitat requirements; sum total of a species' use of the biotic and abiotic resources in its environment
- Competitive exclusion principle: no two species can coexist having the same ecological niche


Resource 2
Species c
Species A
Species B
Resource 1

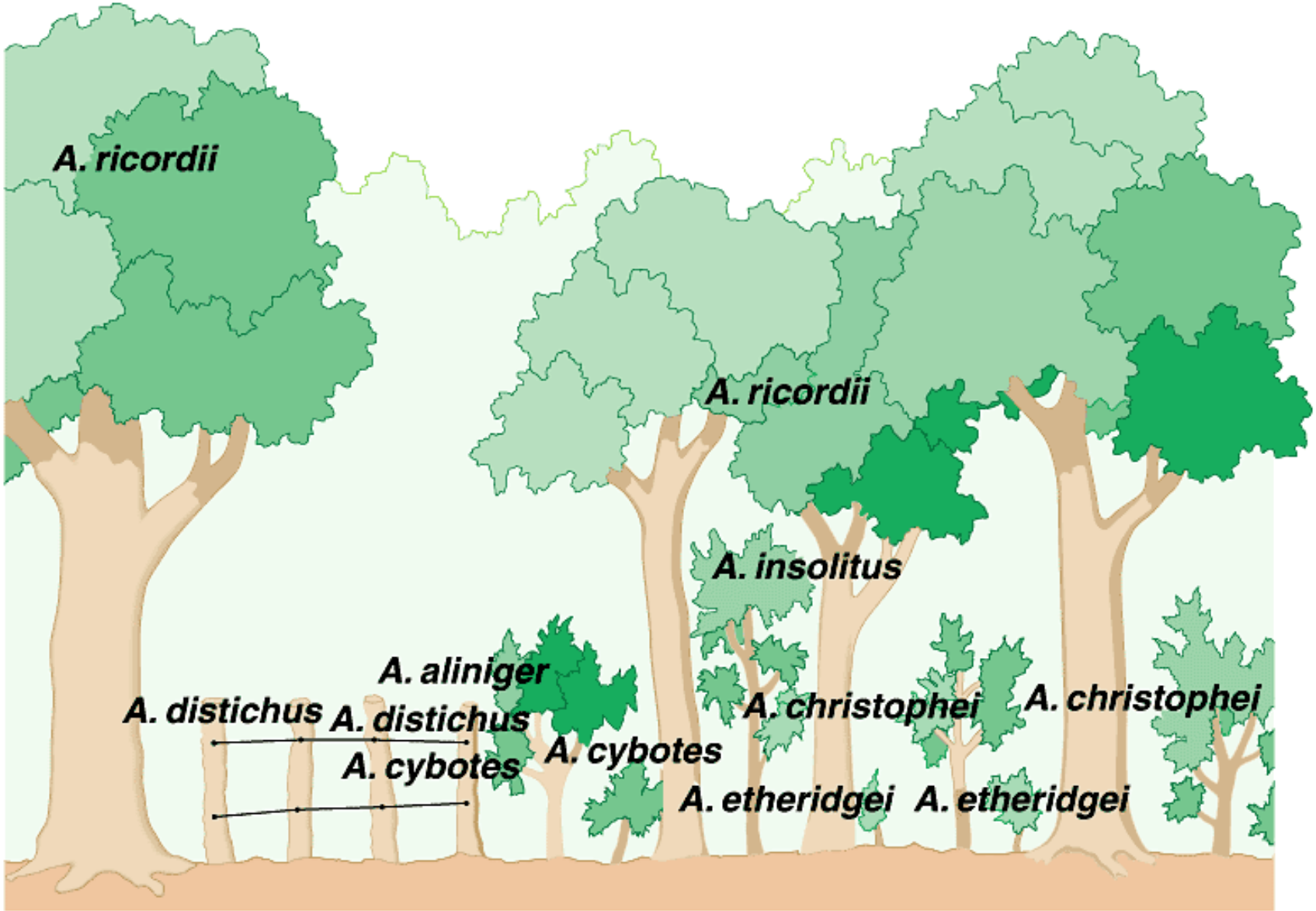
Competitive exclusion principle



Competition theory: How can species coexist?

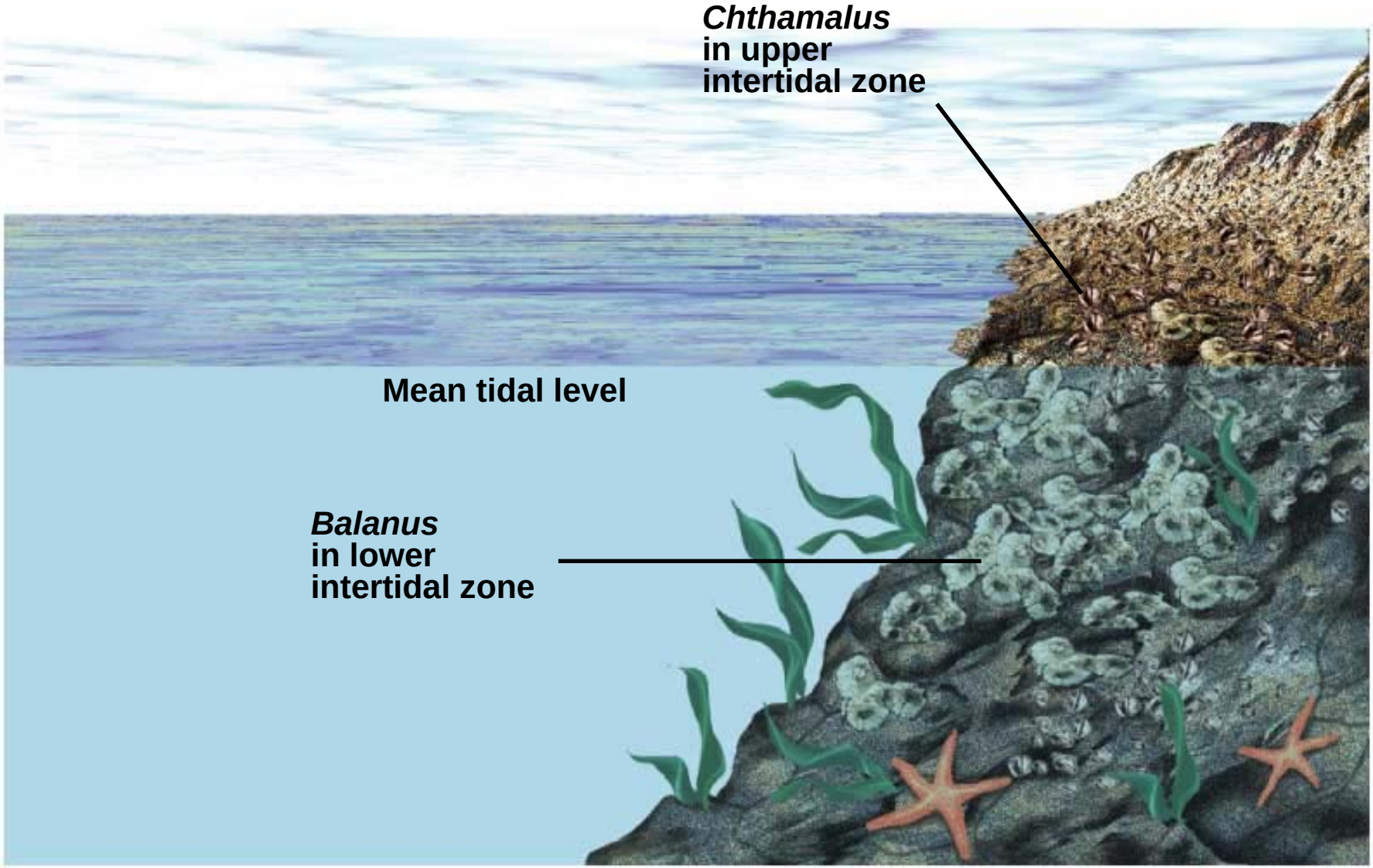
- Niche differentiation occurs through resource partitioning reducing overlap in the habitat/resources used
  - Fundamental niche: the combination of conditions that a species occupies in the absence of competitors
  - Realized niche: the portion of resources or areas used when competition occurs

Resource partitioning in a group of lizards

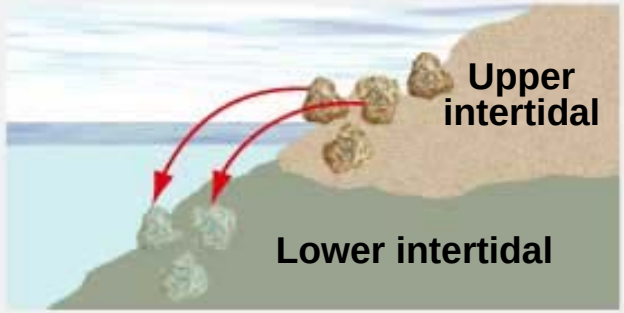


(a)

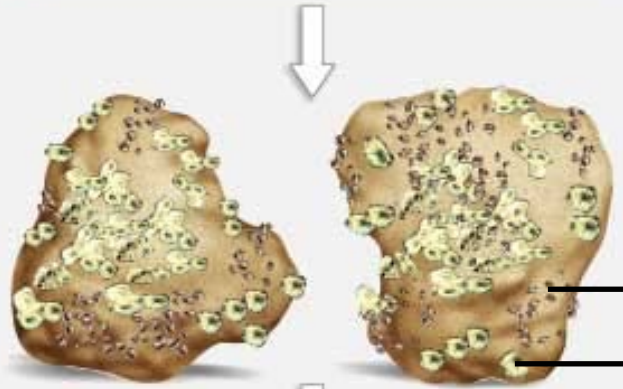
Intertidal competitors



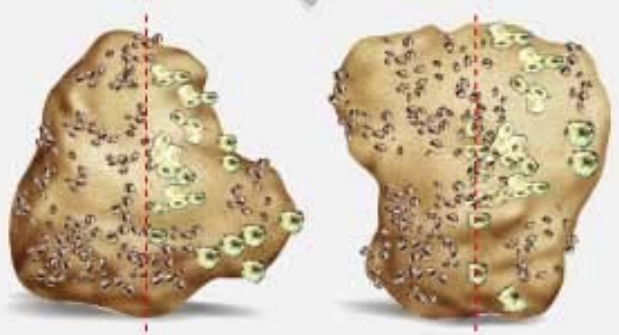
COMPETITION EXPERIMENT



1. Transplant rocks containing young *Chthamalus* to lower intertidal.



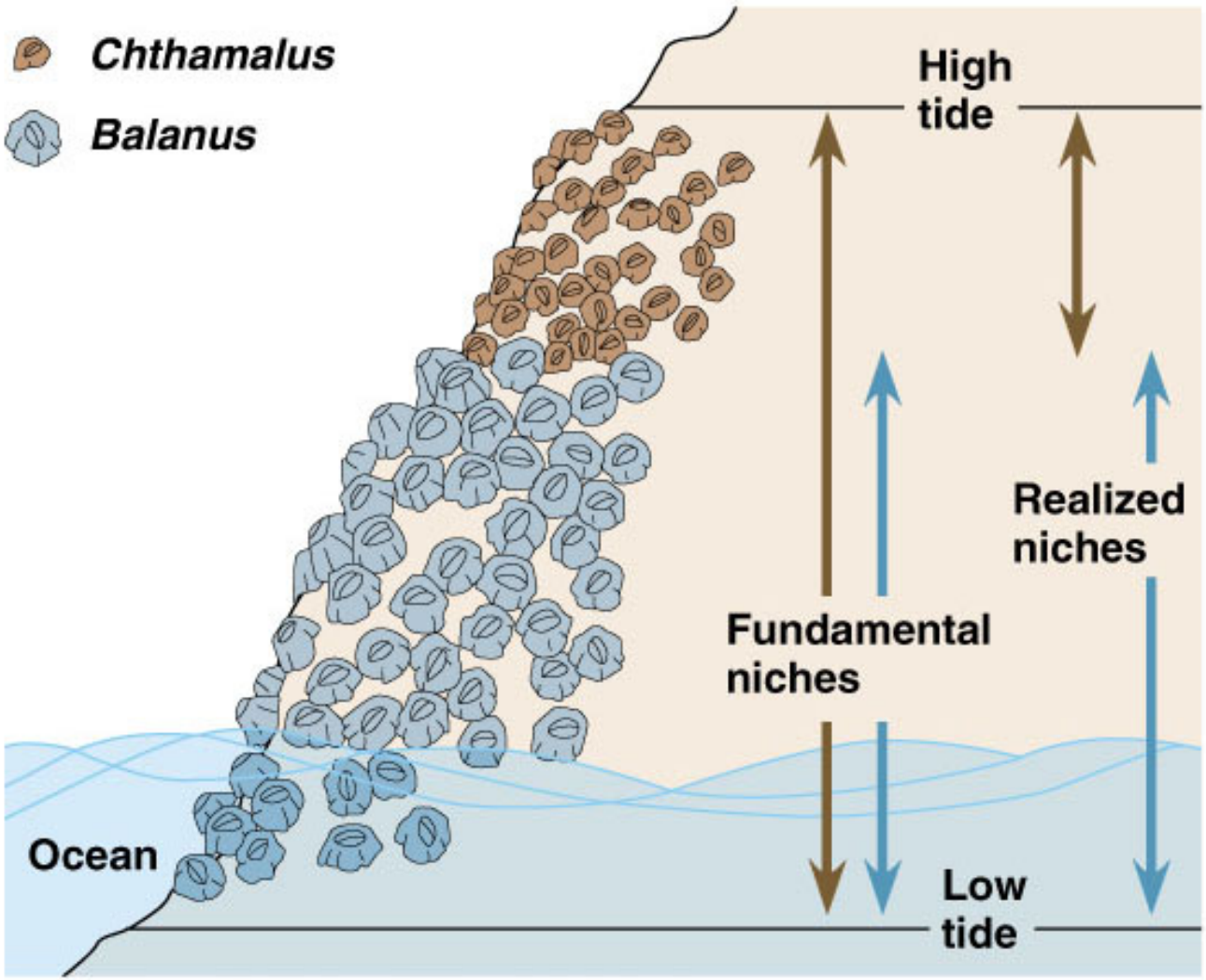
2. Let *Balanus* colonize the rocks.



3. Remove *Balanus* from one-half of each rock. Monitor survival of *Chthamalus* on both sides.

On which side of the rocks do *Chthamalus* survive better?

Fundamental/realized niches



Predation/Parasitism/Herbivory

- Predation: individuals (predator) catch and consume other individuals (prey) therefore removing them from the population
- Parasitism: individuals consume parts of a living prey organism, or host. It can decrease host fecundity and increase probability of host dying
- Herbivory: individuals eat whole plants or parts of plants; herbivores act either as predators or parasites

Predator adaptations

- Acute senses to locate prey; claws, teeth, fangs, stingers, poison to catch and subdue prey; digestive tract modified for specific resource. Examples:
  - Snakes have heat sensing organs to locate prey; poison to kill the prey
  - Insects can locate appropriate plants by using chemical sensors; they have mouthparts adapted for shredding vegetation
  - Digestive tract of herbivores greatly elongated to digest plant materials

Prey Adaptations

- Plant defenses: chemical toxins, spines, thorns. Examples:
  - Morphine from opium poppy, nicotine from tobacco plant, mescaline from peyote cactus
- Animal defenses: hiding, escaping, self-defense, crypsis, physical or chemical defenses, aposematic coloration
  - Examples: various insects achieve crypsis by resembling sticks, leaves or flower parts

Crypsis: Poor-will (left), lizard (right)

Aposematic (warning) coloration in a poisonous blue frog

Mimicry

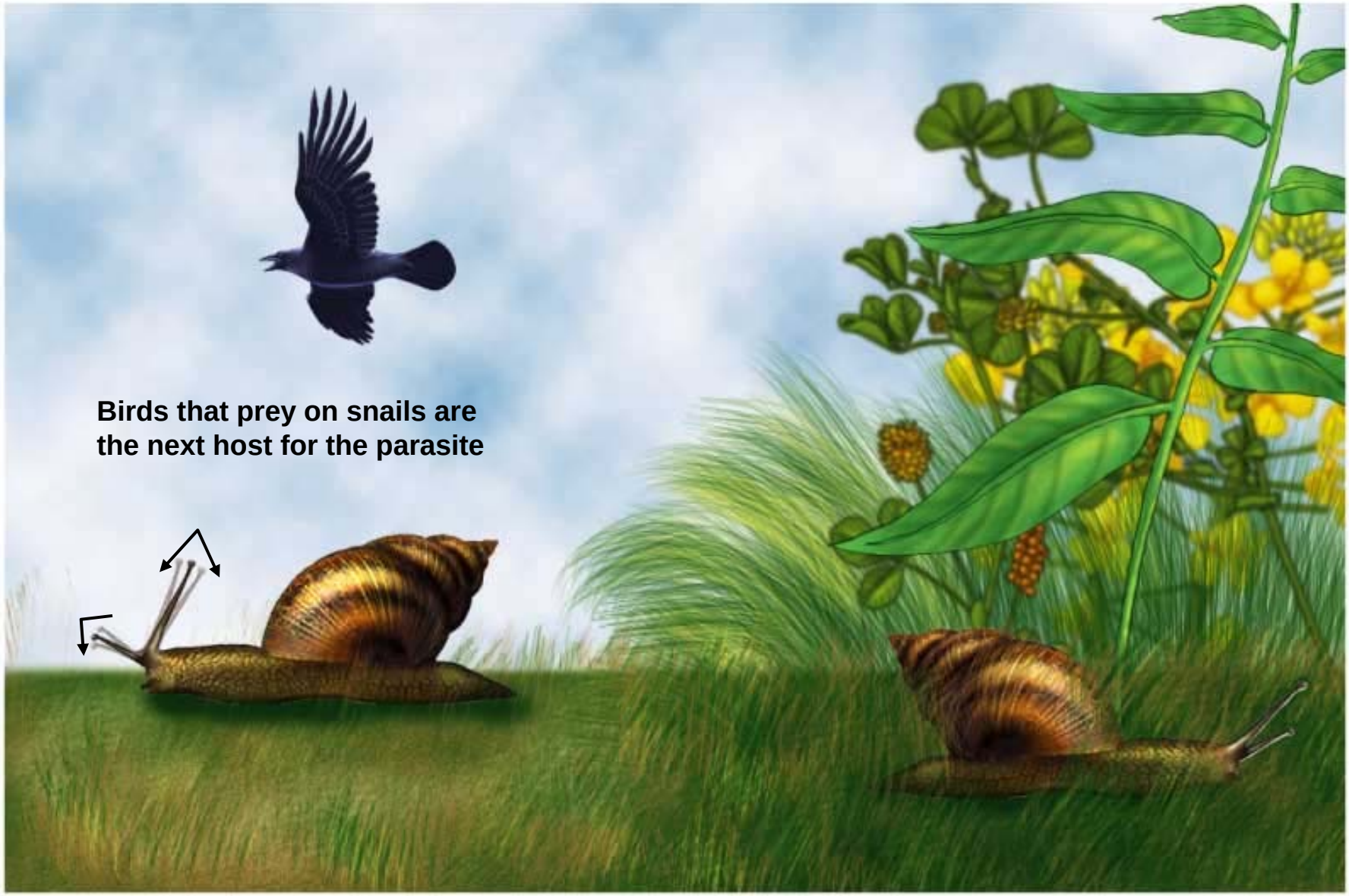
- Batesian: palatable animals mimic the appearance of noxious unpalatable animals. Prey fools predator into sensing it is unpalatable
- Müllerian: unpalatable animals resemble one another. Prey produces cues to enhance learning of bad experience by predators

Batesian mimicry

Müllerian mimicry: Cuckoo bee (left), yellow jacket (right)

Adaptations in parasites

- Transmission: accomplish dispersal through hostile environments via complicated life cycles; some parasites modify behaviors of host to enhance transmission
- Virulence: chemical depressors of host immune system (AIDS virus), mimic host proteins (trypanosomes), coat themselves with hosts' proteins (schistosomes)



Infected snails move to open sunny areas; tentacles wiggle.

Uninfected snails stay in shaded areas; tentacles do not wiggle.

Host adaptations

- Resistance: immunological response through inflammation and antibody production

Mutualism

- Interspecific interaction that benefits both species
- They sometimes require the co-evolution of adaptations in participating species
- Examples: Plant pollination by hummingbirds or bees, mutualism between leaf-cutter ants and fungi, mutualism between fishes

Mutualism between ants and fungus

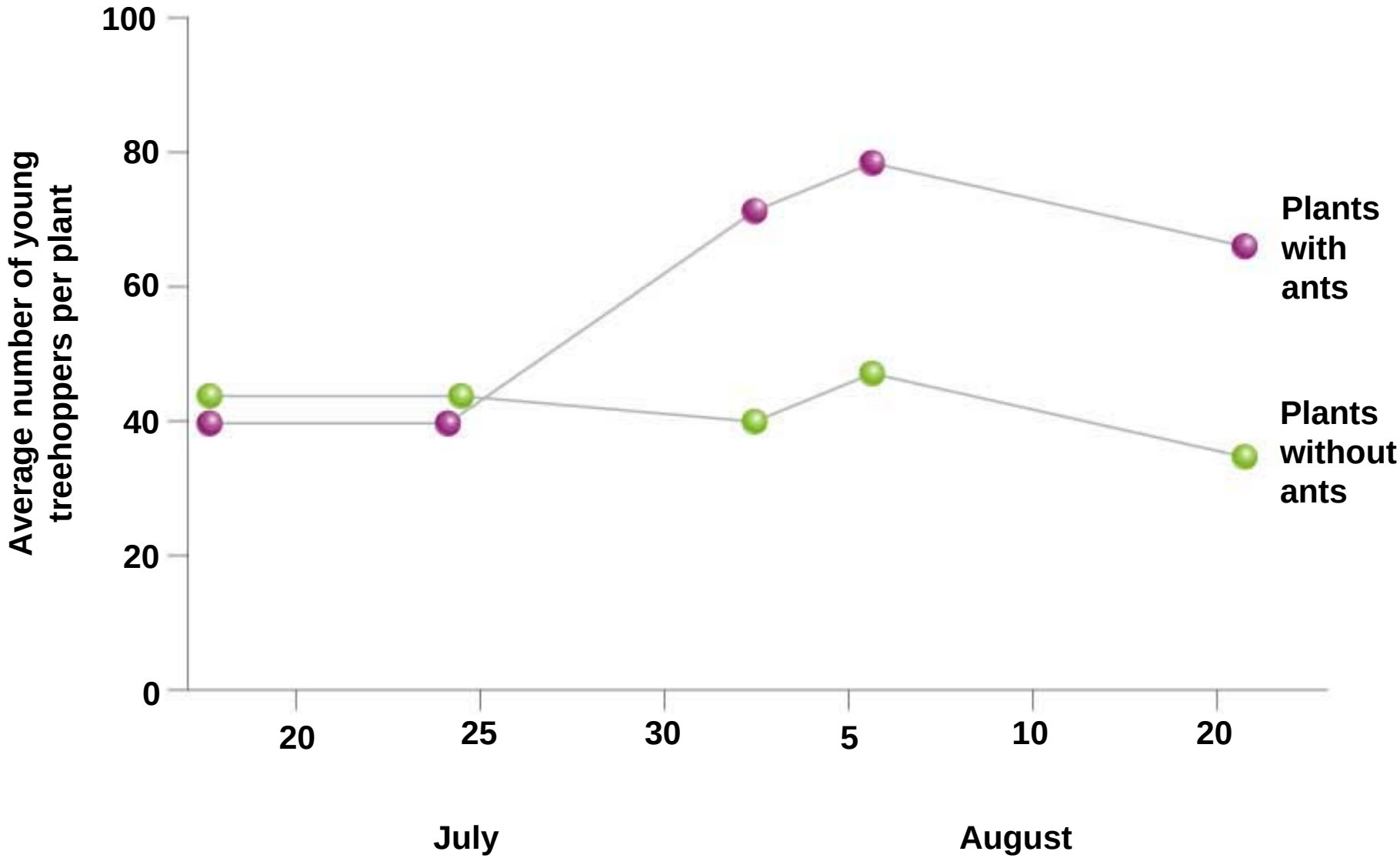
Mutualism between fish

Costs and benefits of mutualism

- Each partner is out to do the best it can by obtaining what it needs from its mutualist at the lowest possible cost to itself
- The net benefit of a mutualism can be measured by subtracting the costs of the interaction against the benefits, in terms of offspring production; the cost-benefit equation may change through time
- Examples: Insect pollinators and nectar producing plants, treehopper and ants

Treehopper excreting honeydew, which is harvested by ants

Which treatment contained more treehoppers?



Commensalism

- Interaction that benefits only one of the species involved in interaction, while the other one is unaffected by the interaction
- Examples:
  - Cowbirds and cattle egrets increase their feeding rates by feeding on insects flushed out by grazing bison, cattle, horses and other hervibores