

Chapter 19 Populations & Communities

- Ecology
- Population Dynamics
- Competition Shapes Communities
- Species Interactions/ Relationships
- Coevolution/symbiosis
- Predation/ animal defenses
- mimicry

Levels of Ecological Organization

Populations

Species

Communities

Ecosystems

Biomes

Biosphere

Population Growth

What is a population? a group of individuals of a species that live together and influence each other's survival

Properties that describe Populations

- population size is the number of individuals in the population

- population density is the population size that occurs in a given area

- population dispersion is the scatter of individuals within the population's range

- Population dispersion
 - The scatter of individual organisms within the populations range.

- Population Growth
 - its capacity to grow

 - Biotic potential, r ,

 - rate at which a pop of a given species increases when no limits are placed on its rate of growth

 - assumes a population grows w/o limits at max rate

 - No matter how rapidly populations grow, they eventually reach a limit imposed by shortages of important environmental factors

 - A population ultimately stabilizes at a certain size, called the carrying capacity

 - K

 - the max # of individuals that an area can support

—The sigmoid growth curve is characteristic of most biological populations

—The processes of competition and emigration tend to increase as a population approaches its carrying capacity

The Influence of Population Density

- commercial fisheries
- attempt to operate so that they harvest a population near its point of maximal sustainable yield

Maximal sustainable yield

- The consequences of exponential growth

Population Demography

- statistical study of populations
- measures characteristics of populations and helps predict how population sizes will change in the future
- populations grow if # births > deaths and shrink if deaths outnumber births
- birth and death rates are dependent on age and sex
- Cohort: a group of individuals of same age

Characteristics of a cohort

- fecundity, or birthrate, (# of offspring produced)
- mortality, or deathrate, (# of individuals that die in that period)
- the relative number of individual's in each cohort defines a population's age structure

Sex ratio: proportion of males and females in pop

- # of births is usually directly related to the # of females
- Age distribution: the proportion of individuals in different age categories
- when a pop lives in a constant environment for a few generations, its pop size remains fairly constant = stable population

A survivorship curve

- expresses the age distribution characteristics of a population
- survivorship is defined as the percentage of an original population that survives to a given age

there are three types of survivorship curves

- type I has highest mortality for the youngest individuals
- type II has relatively the same mortality risk for all ages
- type III has highest mortality for the oldest individuals

Communities

A community is the component of an ecosystem that is living

communities named by their most dominant species (usually a plant)

Niche and Competition

The niche concept

- Niche: an organism's biological role
 - a *pattern of living*
- the sum of all ways an organism uses the resources of its environment, (space, food, etc)
- Fundamental niche is the entire niche that an organism may theoretically occupy
- Realized niche is the actual niche that the organism is able to occupy because of competition

NICHE: all the ways an organism utilizes the resources of its environment

- sometimes species are not able to occupy their entire niche because of the presence or absence of other species

Competition: 2 organisms attempt to use the same resource when there is not enough of the resource to satisfy both

- interspecific competition occurs between individuals of different species
- intraspecific competition occurs between individuals of the same species

How species evolve to occupy different niches within an ecosystem

Species in communities act to avoid competition whenever possible
 2 outcomes are possible

1. competitive exclusion (i.e., winner takes all)
2. resource partitioning: divide up resources creates 2 niches

persistent competition between two species is rare in natural communities

- either one species drives the other to extinction or natural selection reduces the competition between the them

Principle of competitive exclusion	ecologists say no 2 species with the same niche can coexist when 2 species compete for same resource, the superior competitor will drive its rival away
Resource partitioning	natural selection favors changes among competitors to reduce the competition between them each species can avoid competition by using different resources than competitors this reduces niche overlap

Resource partitioning in warblers

Resource partitioning can often be seen in similar species that occupy the same geographical area

- such species are sympatric
- they tend to exhibit greater differences in morphology and behavior than the same two species do when living in different habitats (i.e., when they are allopatric)
- the evident differences are called character displacement
- facilitate habitat partitioning and reduce competition

Resource partitioning among lizards**Coevolution and Symbiosis**

Coevolution: adaptation of a species not only to its physical environment but also to the other organisms that share it

examples of coevolution include

- plants and animal pollinators
- predator-prey interactions
- symbiotic relationships

Many flowers have coevolved with other species to facilitate pollen transfer.

Species Interaction

Coevolution: the long term evolutionary adjustments of species to one another

- Symbiosis
- Mutualism
- Commensalism
- Parasitism

Symbiosis

- Symbiosis is an interaction in which two or more kinds of organisms interact in a close relationship
- the relationship types vary by whether or not each participant is unaffected (0), helped (+), or harmed (-)
- 2 or more dissimilar organisms live together in close association
- 3 major kinds of symbiotic relationships

Mutualism

- both species benefit
- Aphids are small greenflies that suck fluids from plants. Ants carry the aphids to new plants

Parasitism

- one species benefits while other is harmed
- this interaction is really a form of predator/prey relationship but a parasite usually does not kill its host
- the parasite is much smaller than the host and remains closely associated with it
- There are many forms of parasitism in nature
- external parasites
 - ectoparasites,
 - feed on the exterior surface of a host
 - parasitoids are insects that lay eggs on living hosts
- internal parasites
 - endoparasites,
 - feed internally in their hosts
- brood parasitism
 - brood parasites are birds, such as cowbirds and cuckoos, that lay their eggs in the nest of other species for the host to raise

Commensalism

- benefits one species but neither hurts nor helps the other

- there is no clear-cut boundary between commensalism and mutualism

- Examples of Commensalism

Predation

One potential and important interaction in a community involves one organism eating another—called predation

- Both predators (i.e., the eaters) and prey (i.e., the eaten) may undergo reciprocal evolutionary adjustments
- this process is called coevolution

Predator-Prey Interactions

- are an essential factor in the maintenance of communities that are rich and diverse in species
- predators prevent/greatly reduce competitive exclusion by reducing the # of individuals of competing species
- predators that reduce competition and increase community diversity are known as keystone species
- in nature, predators often have large effects on prey populations
- population cycles may be, in some situations, stimulated by predators

“10-year cycle” of the snowshoe hare, *Lepus americanus*, that appears to be under the influence of food plants and predators

- under laboratory conditions, predators may exhaust their prey species and then starve

A predator-prey cycle

- As # of hare rises, # of lynxs rises
- Cycle repeats every 9 yrs.
- Predators and food supply controls # of hares
- # of lynxes is controlled by availability of prey

Plant and Animal Defenses

- Pressures from predation drive the evolution of mechanisms that defend organisms from predation
- plants produce chemical defenses that make them toxic to herbivores
- many animals have defensive coloration

aposematic coloration:

a warning coloration that is characteristic of animals that use poisons

cryptic coloration:

color that blends in with surroundings

—Caterpillar: cryptic coloration (camouflages)

—A blue jay learns that monarch butterflies taste bad

Defensive Coloration

3 Types of Mimicry

- **Batesian mimicry:** a palatable species resembles a poisonous one
the bottom butterfly is the mimic

- **Müllerian mimicry:** several unrelated species come to resemble one another

- **Self Mimicry**
 - one animal body part comes to resemble another body part
 - occurs in both prey and predators
 - prey might use this form of mimicry to startle a predator or to provide a false target for attack
 - predators might use this mimicry to simulate bait to lure prey
 - Eyespots startle predators

Try These

All the animals and plants that live in the same location make up a(n)

- A) biome
- B) population
- C) ecosystem
- D) community

Predators can assist in maintaining the species diversity of an area by

- A) increasing competitive exclusion between prey species
- B) decreasing competitive exclusion between prey species
- C) not affecting competitive exclusion between prey species
- D) decreasing resource partitioning between prey species