Chapter 5

**Biodiversity, Species Interactions, and Population Control**

**Core Case Study: Southern Sea Otters - A Species in Recovery**

* Live in giant kelp forests
* By the early \_\_\_\_\_\_\_\_\_\_ they had been hunted almost to extinction
* Partial recovery since \_\_\_\_\_\_\_\_\_\_
* Why care about sea otters?
  + Ethics
  + Tourism dollars
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ species

**5-1 How Do Species Interact?**

* Five types of species interactions—competition, predation, parasitism, mutualism, and commensalism—affect the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ use and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sizes of the species in an ecosystem

Most Species Compete with One Another for Certain Resources

* Five basic types of interactions
  + Interspecific \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Interspecific competition
  + Compete to use the same \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ resources

Some Species Evolve Ways to Share Resources

* Resource \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Species may use only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of resource
  + At different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* In different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Species Feed on Other Species

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – feeds directly on all or part of a living organism
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Pursuit and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ warfare
* Prey can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ predation
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ warfare
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ coloration
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ strategies

Interactions between Predator and Prey Species

* Intense \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ selection pressures between predator and prey populations
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Interact over a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ period of time
  + Changes in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of one species can cause changes in the gene pool of the other
  + Bats and moths
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of bats and sensitive \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of moths

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

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Parasite is usually much \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than the host
  + Parasite \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kills the host
  + Parasite-host interaction may lead to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In Some Interactions, Both Species Benefit

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ relationship
  + Gut \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mutualism
* Not \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – mutual exploitation

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

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Benefits one species and has \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ effect on the other
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-be careful!
* Birds \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in trees

**5-2 Responding to Changing Environmental Conditions**

* How do communities and ecosystems \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to changing environmental conditions?
  + The structure and species \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of communities and ecosystems change in response to changing environmental conditions through a process called ecological \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Communities and Ecosystems Change over Time: Ecological Succession

* Ecological succession
  + Gradual change in species \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ succession
    - In lifeless areas
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ succession
    - Areas of environmental disturbance
  + Examples of natural ecological \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Ecological Succession Does Not Follow a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Path

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ view
  + Balance of nature and climax communities
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ view
  + Ever-changing mosaic of patches of vegetation in different stages of succession

Living Systems Are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ through Constant Change

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Ability of a living system to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ moderate disturbances
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Ability of a living system to be restored through secondary succession after a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ disturbance

**5-3 What Limits the Growth of Populations?**

* No population can grow \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on resources and because of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ among species for those resources

Most Populations Live in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Population
  + Group of interbreeding individuals of the same species
* Population \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Clumping
    - Species cluster for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Protection from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Ability to hunt in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Populations Can Grow, Shrink, or Remain Stable

* Population size governed by:
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and deaths; \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and emigration
* Population change = (births + immigration) – (deaths + emigration)
* Age \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Pre-reproductive age
  + Reproductive age
  + Post-reproductive age

Some Factors Can Limit Population Size

* Range of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in physical and chemical environment
  + Individuals may have different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ranges
* Limiting factor principle
  + Too much or too little of \_\_\_\_\_\_ physical or chemical factor can \_\_\_\_\_\_\_\_\_\_ or prevent growth of a population, even if all other factors are at or near the optimal range of tolerance
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Populations \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a given area

Different Species Have Different Reproductive Patterns

* Some species:
  + Have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ small offspring
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_parental involvement
* Other species:
  + Reproduce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in life
  + Have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ number of offspring

No Population Can Grow Indefinitely: \_\_\_\_-Curves and \_\_\_\_-Curves

* There are always limits to population growth in nature
* Environmental \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – factors that limit population growth
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ capacity (k)
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ population of a given species that a particular habitat can sustain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Exponential growth
  + At a fixed percentage per year
* Logistic growth
  + Population faces environmental resistance

**Case Study: Exploding White-Tailed Deer Population in the U.S.**

* \_\_\_\_\_\_\_\_\_\_ – deer habitat destruction and uncontrolled hunting
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – laws to protect the deer
* Current deer population \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Spread \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ disease
  + Deer-vehicle \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Eating \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ plants and shrubs
* How can we control the deer population?

When a Population Exceeds Its Carrying Capacity It Can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* A population exceeds the area’s carrying capacity
* Reproductive time lag may lead to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ population crash
* Damage may reduce area’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Humans Are Not \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from Nature’s Population Controls

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Potato crop in 1845
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ plague
  + Fourteenth century
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Current global epidemic

**Three Big Ideas**

* Certain interactions among species
  + Affect their use of resources and their population sizes
* Changes in environmental conditions
  + Cause communities and ecosystems to gradually alter their species composition and population sizes (ecological succession)
* There are always limits to population growth in nature

**Tying It All Together – Southern Sea Otters and Sustainability**

* Before European settlers in the U.S., the sea otter ecosystem was complex
* Settlers began hunting otters
  + Disturbed the balance of the ecosystem
* Populations depend on solar energy and nutrient cycling
  + When these are disrupted biodiversity is threatened