Chapter 16

Populations

Summary of Terms

- **Carrying capacity** The maximum number of individuals or the maximum population density that a habitat can support.
- **Commensalism** A form of symbiosis that benefits one species while having no effect on the other.
- **Community** All the organisms that live in a specific area.
- **Consumer** An organism that obtains food by eating other organisms.
- **Decomposer** An organism that obtains food by eating dead organic matter.
- **Ecological footprint** The amount of land and water area a human population needs in order to produce the resources it consumes.
- **Ecology** The study of how organisms interact with their environments.
- **Ecosystem** All the organisms that live in a specific area and all the abiotic features of their environment.
- **Exponential growth** A model of population growth in which a population grows at a fixed rate per amount of time.
- **Food webs** Diagrams that show "who eats whom" within a community.
- **Interspecific competition** Competition between organisms of different species within a community.
- **Invasive species** A species that has moved from its native habitat to a new area, where it does a lot of ecological damage.
- **Logistic growth** A model of population growth in which growth slows as the population approaches the habitat's carrying capacity.
- **Mutualism** A form of symbiosis that benefits both species involved.

- **Niche** The total set of biotic and abiotic resources a species uses within a community.
- **Parasitism** A symbiotic relationship that benefits one member of the interaction and harms the other.
- **Population** A group of individuals of a single species that lives in a specific area.
- **Producer** An organism that makes organic molecules using inorganic molecules and energy.
- **Symbiosis** A situation in which individuals of two species live in close association with one another, such as is found in parasitism, commensalism, and mutualism.

Detailed Chapter Summary

Ecology is the study of how organisms interact with their environments. These environments include abiotic features as well as biotic ones. Ecology can be studied at the level of the individual, population, community, and ecosystem. A population is a group of individuals of a single species that lives in a specific area. A community consists of all the organisms that live in a specific area. An ecosystem consists of all the organisms that live in a specific area plus all the abiotic features of their environment.

Population ecologists are often interested in population size or population density. Four factors determine how population size changes over time -- birth rate, death rate, immigration rate, and emigration rate. Exponential growth and logistic growth are two models of population growth that are often seen in natural environments. Exponential growth occurs when a population grows at a fixed rate per amount of time. An exponentially growing population increases in size more and more quickly over time. In the real world, exponential growth cannot continue forever. Populations grow exponentially when they have unlimited resources -- or, in the real world, extremely plentiful resources. Exponential growth is often seen (temporarily) in populations that live in unstable environments. These populations may grow exponentially for a while and then crash when resources run out. Logistic growth occurs when population growth slows as the population approaches the habitat's carrying capacity, the maximum population size or density that a habitat can support. Population growth slows at larger population size because of factors such as competition for food or space, disease, and predation. Logistic growth is often seen in stable habitats.

A population's life history describes its schedule of survival and reproduction. A survivorship curve describes the proportion of individuals that survive to a given age. Type I organisms have low death rates early in life, with most individuals surviving until late in life. Type II organisms experience a steady death rate throughout life. Type III organisms have high death rates early in life, with few individuals surviving until late in life. Type I populations are associated with large bodies, late sexual maturity, having few "expensive" offspring, long life expectancy, stable environments, and logistic population growth. Type III populations are associated with the opposite characteristics -- small bodies, early sexual maturity, having many "inexpensive" offspring, short life expectancy, unstable environments, and exponential population growth.

Human population has been growing for thousands of years. There are over 7 billion people on Earth now, and the population is expected to exceed 10 billion by 2100. However, growth is expected to slow in the second half of this century. An age structure diagram shows the distribution of ages within a population. The shape of the age structure diagram reveals how a population is growing -- a pyramid-shaped age structure indicates rapid population growth, whereas a more even structure indicates slower growth. Demographic transition describes a shift from high birth and death rates to low birth and death rates. Many human

populations have gone through such a transition. An ecological footprint describes how much land and water area a human population needs to produce the resources it consumes. Globally, we need 1.5 Earths to sustain our current rate of consumption. But if everyone in the world consumed as much as the average American, we would need about 5 Earths!